1– Other Curricular Issues

A *To what degree are courses offered in a Distance modality (on-line, hybrid, interactive television, etc)? For courses offered both via DL and on-campus, are there differences in student success? (Contact the Office of Institutional Effectiveness , either Laura Massey or Rob Vergun, for course-level data). If so, how are you, or will you address these differences? What significant revelations, concerns or questions arise in the area of DL delivery?*

Presence of DL offerings

The Math SAC offers Distance Learning (DL) courses in on-line, hybrid, and interactive television (ITV) modalities. We strive to make our DL course experience simulate the face-to-face course experience with respect to instructor presence, feedback, and assessment. We use discussion boards to simulate the classroom learning environment, and an array of online homework platforms to assess and prepare our students effectively. A Math SAC DL standing committee is charged with discussing the structure of our current DL courses, as well as developing and maintaining current DL best practices and standards.

All of our pre-college level math courses (except a calculator skills course) have a DL offering, as do most of our lower-division collegiate courses. Courses that are not offered using a distance modality fall into two categories: those on the high end of our collegiate courses, and specialty courses with low enrollments. See Table 1.1.

Approximately 12.3% of PCC math enrollments were into a DL class during the academic year of 2011-2012 [CAN WE UPDATE THIS TO 2012-13?] compared to only 8.5% in the 2007-2008 academic year. While this percentage increase may seem modest, we have seen an enormous increase in overall enrollment over the same period, and the actual number of PCC math enrollments into a DL course has more than doubled (see Table 1.2). shows student enrollment in face-to-face courses compared to online courses over four [CAN WE ADD 2011-12 AND 2012-13?] academic years.

As enrollment demand for DL math courses has increased, we have increased the number of sections that we offer. Between the academic years of 2003-04 and 2007-08, the annual number of sections offered increased from 51 to 78. [COMPARE THIS TO THE ANNUAL NUMBER FOR 2012-13]. As student demand for DL courses requires, we have added more sections and trained more interested faculty in managing DL courses. The resulting increase in sections offers access

?⟨tab:sec3:DLofferings⟩?

Table 1.1: Course Offerings through Distance Learning

Offered as DL	Not offered DL upper division	Not offered DL specialty
020, 030 , 065, 070, 084, 095, 111, 112, 241, 243, 244	251, 252, 253, 254, 256, 261	015, 25C, 26C, 061, 062, 063, 093, 105, 211, 212, 213

2FandDLenrollments⟩?

Table 1.2: Enrollments in Face-to-Face and Distance Learning Courses

Academic Year:	07/08	08/09	09/10	10/11	11/12	12/13
Face to Face						
Distance Learning						

:F2FandDLpassRates⟩?

Table 1.3: Pass Rates For DL and F2F courses among courses with a DL offering

Academic Year:	07/08		08/09		09/10		10/11		11/12		12/13	
	DL	F2F	DL	F2F	DL	F2F	DL	F2F	DL	F2F	DL	F2F
20												
30												
60												
65												
70												
84												
95												
111[1]												
112												
241												
243												
244												

to students that can succeed in this modality and need this option due to outside constraints such as work and family.

Success Rates in DL courses

Pass rates in DL courses are significantly lower than those for their face-to-face counterparts. We recognize that students need a certain level of self-discipline, better study skills, and comfort engaging with technology to succeed in a DL course. However we currently have no method for screening which students are less likely to succeed using a distance modality. Table 1.3 shows the difference in pass rates between the DL courses that we offer and their face-to-face counterparts. It is clear that, in the six academic years shown, the passing rates are generally decreasing regardless of delivery mode. We hypothesize that this overall trend is mostly the result of the economic collapse of 2008 which led to increased enrollment and changes in our student demographics (REF to diversity section?). But the pass rates in DL courses are as much as 30% lower than in face-to-face counterparts and this large discrepancy needs to be addressed.

The difference in student-success rates between on-campus courses and DL courses is an important issue for the Math SAC. The Distance Learning Standing Committee has met to consider this issue and the factors that lead to this difference in success rates. We can only speculate the reason for the disparity based on anecdotal evidence and professional experience. Students may no longer see DL courses as unusual, so they may be unaware that successful DL math students should have stronger study skills, self-discipline, and time management skills than face-to-face math students absolutely need to be successful. We believe that many students register for DL math courses without adequate understanding of the study habits, time commitment, learning styles, and technical skills that are necessary for success in these classes. Anecdotal evidence suggests that some students who are aware of these issues and who would otherwise enroll in a face-to-face section

[1] Combines 111B, 111C, and 111

still enroll in a DL section due to a lack of space in face-to-face sections.

There is currently a DL orientation available for DL students, but there is no requirement that students complete it. Furthermore, there is no information in the orientation to help students understand the particular challenges of studying mathematics using the DL delivery methods. In many disciplines, reading, writing, and discussion can be sufficient for learning. Students in mathematics typically do not learn best until they have also acted, by working through exercises or active problem-solving. In face-to-face classes, instructors can monitor that this learning-through-action is happening more easily. In DL courses, there is more of a need for students to rely on self-discipline to complete this portion of their learning, and this is not communicated in the existing DL orientation.

Informing DL Students

The Course Information Page (CIP) is accessible to students registering for DL courses and is meant to give section-specific information to students as they decide which sections to register for. Many faculty members use this system to inform students of issues related to an online mathematics course. For example, faculty address the misconception that a DL class requires fewer hours of attention per week than a face-to-face class. We believe that many students do not visit the CIP for DL classes and continue to be unaware of the tools they will need to be successful in a DL mathematics course. Some faculty members send emails to registered students before the term starts, asking them to read the CIP. It is still not clear, however, how many students read this email or act on it. The link to a CIP is only available via the online class, and not via MyPCC. This lack of redundancy may be contributing to the issue.

Other methods that are employed by DL faculty to directly communicate with their students include:

- using the Course Progress Notifications (CPNs);
- placing telephone calls to students;
- using Collaborate to hold online office hours in a kind of chat session.

Online Homework platforms

Faculty have sought to increase engagement by DL students through use of online homework platforms. An online homework platform can provide students with immediate feedback and also hold the student accountable for completion of assigned exercises. Faculty can monitor progress and employ formative assessment from a distance.

Faculty members Wendy Fresh, Rebecca Ross, Tammy Louie, Jessica Bernards, and Diane Edwards attempted to investigate the effects of use of an online homework system on pass rates in DL courses in several experiments. The results suggested there may be a benefit to pass rates from using such a platform, however the sample sizes were too small for any statistical significance. Some researching faculty are reluctant to make their data available due to the small sample sizes and their lack of training in experimental design. [POSSIBLY SHOW DATA FROM WENDY AND JESSICA'S STUDY - DATA IS IN A FILE CALLED DATAFROMMMLVSTRADHWBERNARDSFRESH.docx, put in Appendix?]

There is not much published research on the efficacy of online homework compared to traditional homework. What little there is suggests that overall, it is neither more helpful nor harmful than traditional homework (http://physics.wku.edu/~bonham/Publications/HomeworkCompare.pdf,http://www.d.umn.edu/math/Technical%20Reports/Technical%20Reports%202007-/TR%202011/TR_2011_2.pdf). However http://digitalcommons.usu.edu/cgi/viewcontent.

cgi?article=1414&context=etd found that when students are segregated by incoming ability, those who were less prepared when entering a course do benefit significantly from its use. As a community college, we have more underprepared students entering than universities, so this finding suggests that use of online homework may be more helpful at PCC than in places where other studies have shown no effect. It is important to note that each of these studies were done with face-to-face courses; in DL courses the traditional homework alternative presents the challenge of delivery, complicating the question in favor of using online homework.

WeBWorK

Recent exciting developments at PCC have centered around the free and open-source online homework platform called WeBWorK that is partially funded by the National Science Foundation and maintained by the Mathematical Association of America. By spring '14 we expect that over 20 faculty will be using WeBWorK in their courses. The math SAC is also loaning out the services of Alex Jordan to CTE and LDC science SACs to create free online homework review programs. We envision using WeBWorK for future Learning Assessment research and placement advising. We are working with Dual Credit instructors to offer WeBWorK services to Portland Public Schools.

Most of the textbooks currently in use by the Math SAC are published by Pearson Publishing, which offers MyMathLab for its online homework platform. While MyMathLab and similar commercial products come as a bundled expense with new textbook purchases, a separate online account for pairing with a used textbook purchase is rather expensive. For this reason, face-to-face instructors rarely require MyMathLab in their courses. On the other hand, Distance Learning instructors have a stronger need for an online homework platform and the majority of DL instructors do require that students use (and pay for) My MathLab.

By contrast, WeBWorK is a platform for online homework that is free and open-source. As there is no central headquarters for WeBWorK, it must be installed on a server somewhere. Since joining the Math SAC in spring of 2009, Alex Jordan has championed the implementation and use of WeBWorK at PCC. Some PCC math faculty have used WeBWorK in various capacities by borrowing server space from the University of Oregon, a relationship formed and maintained by Jordan. This partnership between two Oregon state institutions has been mutually beneficial. While PCC gained server access, PCC faculty members were programming content that UO has been able to take advantage of. Each term since Fall 2011, roughly 10 sections of PCC math courses have used the UO server.

Over this period, WeBWorK users in the Math SAC lobbied Technology Solution Services to provide the Math SAC with its own WeBWorK server. While the UO server provided service to us, it came with certain restrictions and complications that prevented WeBWorK at PCC from reaching its full potential. For a time there was a chicken-and-egg situation, as TSS requested a greater usage by PCC faculty before arranging for a server while some faculty chose not to use WeBWorK because of the inconvenience of using the UO server.

In the 2012/13 academic year, faculty Chris Hughes and Scot Leavitt researched accessibility issues (in the ADA sense) alongside Disability Services (REF accessibility report, and paragraphs in this document- not sure where they reside yet). Among many other findings, they found that MyMathLab (at the time of the project) had many significant accessibility problems while WeBWorK was quite close to being fully ADA compliant. The open-source nature of WeBWorK meant that the few remaining obstacles to accessibility could be addressed. They recommended that the SAC cease using MyMathLab for newly developed courses and newly developed online shells. They also recommended that faculty migrate from MyMathLab to WeBWorK. Disability Services supported their recommendations, and also began lobbying TSS for a PCC WeBWorK server. Within the WeBWorK community PCC is now seen as a leader when it comes to accessibility issues (CITE: http://michaelgage.blogspot.com/2013/11/webwork-accessibility-projects.html). As

a result of this, PCC is hosting a WeBWorK development camp in August 2014 with a central theme of addressing accessibility issues and enhancing its accessibility.

TSS provided an initial server to the math SAC in early summer of 2013. Due to technical difficulties, that server was put on the back shelf while a superior server could be put in place hosted by the Clackamas Education Service District (a technological partner of TSS). Both this new installation of WeBWorK (webwork.pcc.edu) and the earlier one (webwork-devel.pcc.edu) are now under control of the Math SAC. During Fall 2013, SAC members Alex Jordan, Chris Hughes, and Xiaolong Yao are preparing webwork.pcc.edu for regular use during the winter 2014 term. The other server at webwork-devel.pcc.edu remains in place for faculty to experiment with.

The arrival of our own WeBWorK installation has significant implications beyond homework management, particularly in the advising department. We envisage that advisors would enroll students in a 'review course' that contains (mostly) pre-college practice problems, and that the student would be encouraged to sit the Compass placement test only when they are comfortable with the problems in WeBWorK. Furthermore, we can easily use WeBWorK as an advising tool to replace Hughes' Placement Advisory Test in situations when students are not happy with their placement from Compass. Recommendation (will add below if this is the appropriate place, otherwise will move it): We need to collaborate with advising on this important placement issue- this idea can only succeed with their support.

PCC WeBWorK problem library

WeBWorK has been in use at universities for some time now, and an extensive library exists of math problems for college-level courses. However there was weak content support for basic algebra and other pre-college topics. Over summer of 2013, Alex Jordan, Chris Hughes, and Xiaolong Yao oversaw an effort to create a library of high-quality, algorithmically generated, basic algebra WeBWorK exercises which was partly funded with an IIP development grant; they received support from Kandace Kling, Debbie Neft, Jeremy Shaw, and Danielle Rice. These exercises currently cover topics from MTH 60 and 65, and the team continues to add problems to the library for MTH 95. The library development was a success because of the strong collaboration and dedication of the three faculty members, and the foundations that Jordan had laid in previous years. Jordan, Hughes, and Yao presented their work at the STEM showcase (Rock Creek) in Fall 2013 (see Figure REF). It was at this showcase that the idea was hatched to create free online homework review programs for CTE and LDC science SACs.

As time and funding progress, SAC members with the requisite coding experience hope to add more problems to this PCC library, expanding into the arenas of MTH courses 20, 111, 112, 243, and 244. It is important to note the level of quality of the problems from this library. Each problem has a full walk-through solution coded along side the question which can be put to use by faculty in a number of ways. Each problem is given fine attention to detail so that automated feedback messages to the students are as informative as modern technology can allow. This high level of quality requires time and experience to achieve.

Concerns about DL offerings

Each of the following three issues have been raised by SAC members and during the 2012/13 academic year a group of concerned faculty met to discuss them. The meetings were informal and no binding decisions were reached.

- Faculty are concerned about whether or not Distance Learning is an effective way to deliver math content, especially in light of the low pass rate statistics. Successfully learning mathematics generally requires heavy active engagement. Face-to-face courses facilitate this

engagement by requiring students to be in the physical presence of their instructor and fellow students. In DL courses, the imperative to remain engaged comes almost entirely from the student's own sense of responsibility and interest.

- Faculty are concerned about the quality and consistency of current DL courses. Some faculty rely on publisher content such as electronic versions of textbooks, while other faculty have created complete sets of online notes themselves and use e-books only as secondary resources. Instructor Chris Hughes serves as an advisor to online faculty creating new courses, and makes recommendations to improve course quality and observe accessibility standards. However there is no enforcement of the online advisor's recommendations.
- Faculty are concerned about the portion of a student's grade that may be computed from online homework. Compared to traditional homework, online homework is more readily vulnerable to cheating. With many math exercises, the exercise can literally be typed in to Google and the search engine itself provides an answer. Online homework provides fewer obstacles for a dishonest student to employ someone else to do their homework for them. In fact, in Craigslist sites nationwide, all one need do is search for 'mymathlab' to find advertisements from those who will 'take your online math course for you' at a cost. The math SAC has always wanted its online courses to mirror its face-to-face courses, and as a consequence has never created CCOGs that treat face-to-face and online courses differently. This has made it difficult to place any cap on the portion of a grade that may be computed from online homework. There is also no consensus on what an appropriate cap could be.

Recommendations

Our main recommendations concern how to best inform students about the particular skills that a distance learning student should have or adopt in order to be successful. We also recommend enacting some prerequisite items for DL registration to help give these skills to students. Lastly there are some recommendations that do not fit these descriptions.

- Have the online orientation linked from the registration tool in MyPCC and require that students complete this orientation before registering for a DL class.
- Include a section in the DL orientation that addresses the specific challenges that DL brings to mathematics courses. Perhaps only students seeking to register for a mathematics DL course would be required to complete this section.
- Include a pop-up or hover-over window that is activated when a student tries to registers for a DL class that gives specific information about the course and its delivery method.
- Require students to demonstrate pre-requisite computer literacy skills such as those taught in basic internet skills (CAS 104), beginning Word (CAS 216), beginning keyboard (CAS 121), and basic computer skills/MS Office (CAS 133).
- Develop and require a basic DL/computer skills competency course, possibly offered during week 0 of the term.
- Academic advising should give students tips on DL responsibilities and make students aware of the difference in student-success statistics between DL and face to face courses.
- Academic advising should encourage students to contemplate why they seek to take a DL course and reflect upon whether it will be aligned well with their learning style and personal skill sets.
- Add redundant access to the Course Information Page. Along with access through the online Class Schedule, the CIP could be available through MyPCC on the home page for a course, and through Desire To Learn.

- The SAC and administration should consider how and if the quality of online courses could be regulated more.
- Administration should provide opportunity for faculty professional development in research design and data analysis to help with research efforts on the efficacy of online homework.
- Administration should provide release time for further development of WeBWorK related projects, including a larger library of math problems for other courses, enhancements of the WeBWorK engine, and creation of content for other SACs at PCC.

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

Math 111H College Algebra: Honors

The course has been offered only at Sylvania campus – Winter '12 (12 students), Winter '13 (22 students), Spring '13 (15 students), and Fall '13 (17 students). Ronda Lively was the instructor the first three terms, which allowed her to evolve her materials and activities. Currently, Ann Cary is teaching the Fall '13 term, and has collaborated closely with Ronda Lively.

The honors course must cover all of the same material as the regular course. It is stressed that honors versions of a course should not be "harder", but different in the use of class time and activities/assignments. There should also be a component of Community and Environmental Responsibility, which is a PCC core outcome that is usually difficult to place in math courses. Lively regularly teaches MTH 111 and MTH 111H during the same term. The same exams are given in both courses. There were differences in the other evaluation criteria used in the courses. In the MTH 111 class, students submitted take home graded worksheets and participated in an in-class graded group activity. The evaluation of the students in the MTH 111H class included:

- a collaborative computer project involving math history and investigation of several applications of math
- a team quiz-grading activity where each group wrote a key and grading rubric, then applied to two (fictional) students' quizzes
- a community tutoring project: over several weeks, they found someone to tutor in math (friend, neighbor, family member, ...) and then wrote a paper on their experience

Since the overall student ability level was high, there was time in class to investigate other topics of interest related to college algebra. Each term there were several students enrolled that signed up because of the time slot, not because they were strong in math. An encouraging development was that the stronger students took the less prepared students under their wings and helped those few struggling students be successful.

Social Justice Workgroup

A Math and Social Justice workgroup was formed by Ann Cary and Emiliano Vega in response to a national convention they attended. The group has collected and disseminated data sets and activities to participating instructors and has gained interest and participants from other disciplines at PCC as well as area high school math instructors and community activists in Portland. More importantly, the group has the focus of providing a forum on how to discuss potentially sensitive subjects in a classroom setting when using application problems and how to be more culturally and socially aware of individual students and classes. The information they gathered has been brought to participating instructors and has improved the pool of activities and application problems available, improved the ability of instructors to work effectively with the broad demographic

of students and co-workers, and also continues the college's focus on two Core Outcomes: Community and Environmental Responsibility and Cultural Awareness.

Service Learning

Service Learning has been a part of many math instructors' courses at PCC, but has been deepened and new supports exist through the Service Learning website. The Service Learning website includes additional resources and syllabi submitted by participating Instructors at PCC. In addition, Service Learning will been added to some CCOGs evaluation criteria to encourage instructors to incorporate Service Learning in their math classes. In addition, Jeff Pettit participated as an observer in the Service Learning training cohort at Sylvania campus, connecting with instructors in other disciplines and understanding how Service Learning is employed in other courses. This has led to new curriculum in his Statistics courses and upper-division courses where Service Learning was not originally employed.

Developmental Education Math Study Group

A new committee was formed by the SAC to address developmental math completion rates. The committee is researching the feasibility, cost and difficulty associated with implementing "pathways" beyond the current calculus focused MTH60-95 courses. The committee is considering options for employing career-based math course series and a statistics-based math course series.

In addition, a committee is being formed to address placement test reform. The group intends to better measure students' needs beyond the current math-skills Compass test. We hope to find a way to measure key traits and needs of students to connect student populations with the support needed to better guarantee success.

C *Are there any courses in the program that are offered as Dual Credit at area High Schools? If so, describe how does the SAC develops and maintains relationships with the HS faculty in support of quality instruction. Please note any best practices you have found, or ideas about how to strengthen this interaction.*

During the 2012/2013 academic year, PCC dual credit for mathematics was awarded for seven mathematics courses. Classes were offered at seven high schools and there were a total of twelve instructors certified to teach PCC dual credit mathematics classes. There were a total of 750 unduplicated students who enrolled in at least one PCC dual credit mathematics class and collectively those students earned 6032 mathematics credits through PCC. In the fall term of 2012, an ad hoc committee was formed in the mathematics SAC to investigate the status of our dual credit program. The formation of this committee was prompted, in part, by the discovery that several of the posted dual credit syllabi described courses that bore little resemblance to the course for which students were earning PCC credit. The committee decided that the root cause of this disconnect was a lack of robust support on our part. Three concrete actions were taken to address the disconnect:

- The first action taken was that each dual credit mathematics instructor was assigned a team of two support faculty from the mathematics departments at PCC. Each pair of support faculty visited their assigned instructor at that instructor's high school. These meetings were rather informal; the intent being to establish a concrete support team for each high school instructor.
- The second action taken was the creation of a two-day mandatory summer workshop organized by the committee in conjunction with Beth Molenkamp; at that time Beth was the coordinator of PCC's dual credit program. At the workshop each dual credit instructor was

tasked to complete a robust (and accurate) syllabus for each of their dual credit classes. The PCC faculty helped with this task and all of the dual credit instructors now have syllabi that truly reflect the nature of the course for which the students are earning PCC credit. The remainder of the workshop was spent sharing resources and pedagogical tactics used by various PCC faculty in the courses for which dual credit is also offered.

- The third action taken was the creation of a Google Drive site to share resources. Although the inspiration for this site was to give our dual credit faculty easy access to shared resources, the pooling of resources is obviously of great benefit for PCC faculty as well.

D *Does the SAC plan to develop any additional Dual Credit agreements with area high schools? If so please describe. If not, what does the SAC see as barriers to developing further dual credit agreements.*

Students at Central Catholic High School will get their first opportunity to earn PCC mathematics dual credit during the 2013/2014 academic year. This adoption was coordinated through the dual credit program; that is, the math SAC played no active role in the creation of this dual credit agreement. There is concern in the mathematics SAC that the state's 40-40-20 initiative, and the accompanying bills aimed at encouraging high school students to earn college credits, might lead to a dramatic increase in the number of high schools offering dual credit for mathematics courses. What's most worrisome about this is that there just are not that many high school mathematics instructors who meet PCC's qualifications to teach post-100 level mathematics courses. We are concerned that the day might come where we are pressured to lower those standards or, of even more concern, we are pressured to start awarding PCC dual credit for developmental mathematics courses (MTH 95 or below).

A– Changes in ALC courses

?⟨app:sec:alc⟩?

After MTH 20 was moved to the Math SAC, the ALC Math courses were the only math courses left in the DE SAC. The ALC instructors therefore requested that these courses too would be moved to the Math SAC. After the DE and Math SACs gave their support, the courses were moved in January 2013.

Historically, the ALC math courses have only included curriculum up to MTH 65, but after the move was completed, the Math SAC voted to also include MTH 95 curriculum. The new course forms have been submitted to the Curriculum Committee.

Furthermore, the ALC math courses have been impacted by the new no-repeat policy. Historically, these courses could be repeated many times because they included three levels (now four). Following is a listing of the current and the new/changed courses:

Current courses:

ALC 60 “Basic Math Skills Lab”

ALC 61 “Basic Math Skills Lab”

ALC 62 “Basic Math Skills Lab”

ALC 63 “Basic Math Skills Lab”

New courses:

FIX

ALC 20A “Math 20 Review - 0 credits” ALC 20B “Math 20 Review - 1 credits” ALC 20C “Math 20 Review - 2 credits” ALC 20D “Math 20 Review - 3 credits”

ALC 60A “Math 60 Review - 0 credits” ALC 60B “Math 60 Review - 1 credits” ALC 60C “Math 60 Review - 2 credits” ALC 60D “Math 60 Review - 3 credits”

ALC 65A “Math 65 Review - 0 credits” ALC 65B “Math 65 Review - 1 credits” ALC 65C “Math 65 Review - 2 credits” ALC 65D “Math 65 Review - 3 credits”

ALC 95A “Math 95 Review - 0 credits” ALC 95B “Math 95 Review - 1 credits” ALC 95C “Math 95 Review - 2 credits” ALC 95D “Math 95 Review - 3 credits”

?⟨sec:app:coreoutcomes⟩?

B– Core Outcomes Mapping

Mapping Level Indicators:

1. Not Applicable.
2. Limited demonstration or application of knowledge and skills.
3. Basic demonstration and application of knowledge and skills.
4. Demonstrated comprehension and is able to apply essential knowledge and skills.
5. Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.

Core Outcomes (CO):

1. Communication.
2. Community and Environmental Responsibility.
3. Critical Thinking and Problem Solving.
4. Cultural Awareness.
5. Professional Competence.
6. Self-Reflection.

Course	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
MTH 10	Basic Math	4	0	4	0	4	3
MTH 20	Basic Math	4	0	4	0	4	3
MTH 30	Business Mathematics	4	0	4	0	4	3
MTH 60	Introductory Algebra, 1st term	4	0	4	0	4	3
MTH 61	Introductory Algebra, Part I	4	0	4	0	4	3
MTH 62	Introductory Algebra, Part II	4	0	4	0	4	3
MTH 63	Introductory Algebra, Part III	4	0	4	0	4	3
MTH 65	Introductory Algebra, 2nd term	4	0	4	0	4	3
MTH 70	Introduction to Intermediate Algebra	4	0	4	0	4	3
MTH 91	Intermediate Algebra, Part I	4	0	4	0	4	3
MTH 92	Intermediate Algebra, Part II	4	0	4	0	4	3
MTH 93	Intro to TI Graphics Calculator	4	0	4	0	4	3
MTH 95	Intermediate Algebra	4	0	4	0	4	3
MTH 111	College Algebra	4	0	4	0	4	3
MTH 112	Elementary Functions	4	0	4	0	4	3
MTH 211	Foundations of Elementary Math I	4	0	4	0	4	3
MTH 212	Foundations of Elementary Math II	4	0	4	0	4	3
MTH 213	Foundations of Elementary Math III	4	0	4	0	4	3
MTH 241	Calculus for Management	4	0	4	0	4	3
MTH 243	Statistics I	4	0	4	0	4	3
MTH 244	Statistics II	4	0	4	0	4	3
MTH 251	Calculus I	4	0	4	0	4	3
MTH 252	Calculus II	4	0	4	0	4	3
MTH 253	Calculus III	4	0	4	0	4	3
MTH 254	Calculus IV	4	0	4	0	4	3
MTH 259	Single Variable Calculus Review	4	0	4	0	4	3

MTH 256	Differential Equations	4	0	4	0	4	3
MTH 261	Applied Linear Algebra	4	0	4	0	4	3

C– Course Scheduling Pattern (by campus)

?⟨sec:app:courseschedule⟩?

1 *Cascade*

1. Scheduling is term by term, which helps us adjust to enrollment changes and part-time faculty changes.
2. Class size for all Cascade math classes is capped at 35 (if room allows) except MTH 20/61/62/63, which are capped at 30.
3. Since the last program review, we have regularly offered many more MWF classes, especially for MTH 95, in order to try to improve retention and success. MWF classes, meeting for shorter times than typical MW/TuTh classes, enable us to âĂIJpackâĂİ more classes into a school day and therefore maximize our usage of the rooms we are assigned.
4. We discontinued MTH 91/92 because we felt that the sequence was inadequately preparing students for MTH 111.
5. We continued to innovate with regard to hybrid offerings, including weekday and Saturday hybrids.
6. We eliminated Sunday hybrids when Cascade decided to eliminate Sunday class offerings. Since we were beginning to see declines in enrollment anyway, this did not seriously impact student access to classes. The Saturday hybrids are still available.

2 *Rock Creek*

1. Rock Creek schedules term by term. It would help with staffing decisions if the classes would be assigned rooms well ahead of the date the class offerings become visible to students online and the deadline for the photograph proof of the paper class schedule.
2. Rock Creek offers mostly two day a week classes (82%) meeting from 7am to 9 pm, about 10% one day a week either Saturday or Friday mornings, and 8% online.
3. Rock Creek schedules courses at the Hillsboro Center, Willow Creek Center and St Helens (12% of class offerings at RC).

3 *Sylvania*

1. Scheduling is done one year ahead, which helps students plan out their year
2. Coordination between campuses for low enrollment or specialty courses
3. Newberg Center, scheduled by Sylvania, gives more students better access
4. Increased offering of Distance Learning courses also increases accessibility for students with scheduling conflicts

5. Class size for all Sylvania math classes is capped at 34 (if room allows) except Statistics (23-28 for computer classrooms)
6. Reorganized time slots for 2013/14 to lower possibility of canceled classes (due to room availability or low enrollment)

D– DL survey summary

⟨app:sec:dlsurveysummary⟩?

Survey data details: $n = 976$ face to face and $n = 291$ online responses.

FIX

1. Have you used any of the resources available through the library (e.g. calculator, netbook, or iPad rentals, textbook checkouts, scanners, or online database search engines) during your time as a student in a PCC math course?

   (a) Yes. I frequently used these resources.

   (b) Yes, but I seldom/rarely used these resources.

   (c) No, but I knew that such resources were available.

   (d) No, and I was unaware that such resources were available.

   We found that our students both in face-to-face and online classes are generally knowledgeable about library and out of the classroom resources such as calculator rentals, netbook and iPad rentals, textbook checkouts, scanners and online searchable databases.

FIX

	Student knowledge of library and out-of classroom resources
Face-to-face	81.45%
Online/hybrid	74.25%

   Not surprising that library and other out-of-the-classroom information is being used more frequently by our face-to-face students than that of online students. This could be due to less frequent visits to campus for online students and/or online students already have the resources available to them.

	Actual use of library and out-of-classroom resources
Face-to-face	48.76%
Online/hybrid	25.77%

2. Were the library and related resources listed on your most recent math course syllabus?

   (a) Yes, it is listed on the syllabus with links.

   (b) Yes, it is mentioned but no links are provided.

   (c) No, it is not listed as a resource.

   (d) I don't have a copy of the syllabus available.

   We found that both Part-time faculty and Full-time faculty included information regarding library and out-of-classroom resources on their syllabi.

	Percentage of classes where the syllabus included resources
Part-time faculty	69.41%
Full-time faculty	69.48%

The data suggests that there was very little distinction of which classes encourage more students to use outside resources in both our college level and pre-college level mathematics.

	Percentage of classes where the syllabus included resources
College level	70.05%
Pre-College level	68.83%

3. Does your current math course have online homework and/or online assessments available (e.g. WeBWorK, MyStatLab, MyMathLab, ALEKS)?

   (a) Yes, it is required.

   (b) Yes, but it is optional.

   (c) No such resource is available.

   Online homework has grown in popularity over the past few years. There has been much debate within our SAC if students should be required to use online homework in face-to-face and online classes. The question has often been raised if students should be required to pay an extra cost for such features and if so, what is a reasonable cost to the student? The data shows a general trend that online homework programs such as Webwork, MyMathLab, MyStatLab, and ALEKS are being used more frequently in online than face-to-face classes.

	Percentage of classes requiring online homework
Face-to-face	13.93%
Online/hybrid	70.45%

   Data suggests that significantly more Full-time instructors are offering some form of online homework (either required or optional) than that of Part-time instructors. This discrepancy may reflect the need to convey and distribute more information about these programs should Part-time instructors want to offer similar options to their students.

	Percentage of classes offering some form of online homework
Full-time faculty	70.78%
Part-time faculty	54.93%

4. I am willing to pay up to $35 extra for access to online homework and resources that may help me succeed.

   (a) Strongly agree

   (b) Agree

   (c) Neutral

   (d) Disagree

   (e) Strongly disagree

   When asked if students would be willing to pay up to $35 to access online homework and resources that may help them to succeed, we found that online students were more willing to pay an extra fee. It should be mentioned that we previously mentioned data that online students were more likely to have used online homework and hence be better equipped to compare cost versus benefit. In contrast, a student who has not been previously exposed to an online homework system may not be able to properly address possible benefits and instead answer purely based on willingness to pay the given dollar amount.

	Percentage of student willing to pay for online homework
Face-to-face	18.44%
Online/hybrid	42.61%
	Percentage of student unwilling to pay for online homework
Face-to-face	56.86%
Online/hybrid	27.14%

Note that the above values do not include the students who responded âĂIJneutralâĂİ on the question as these differences were not statistically significant.

5. What Learning Management Software are available for your math course? Bubble in all that apply.

   (a) Instructor web page

   (b) D2L and/or MyPCC

   (c) MyMathLab or MyStatLab

   (d) Other

   (e) None of the above

6. Of the available Learning Management Software, which ones have you used? Bubble in all that apply.

   (a) Instructor web page

   (b) D2L and/or MyPCC

   (c) MyMathLab or MyStatLab

   (d) Other

   (e) None of the above

   We found that a majority of our courses are using outside resources to connect with students. These resources include but are not limited to personal instructor websites, DesiretoLearn, MyPCC, MyMathLab, MyStatLab, etc.

	Percentage of classes offering additional resources
Face-to-face	89.75%
Online/hybrid	99.31%

A larger separation existed for Part-time instructors who do not use any of the above mentioned resources. This could be due to lack of information or lack of knowledge about available resources.

	Percentage of classes offering additional resources
Full-time faculty	95.32%
Part-time faculty	86.72%

Overall MyMathLab and MyStatLab are used more frequently in pre-college level classes in contrast to college level classes.

	Percentage of classes offering MML or MSL
College level	31.49%
Pre-College level	48.54%

7. What resources available from the PCC Math Department have you used? Bubble in all that apply.

   (a) Course supplements

   (b) Calculator manuals

   (c) Math 251 Lab Manual

   (d) Other

   (e) None of the above

   Our math department website offers additional materials for students. This includes course specific supplements to the textbook, calculator manuals specific to PCC math courses, required Calculus 1 lab, and other information regarding course description. Students may print these materials for free from any PCC computer lab.

8. What graphing software programs have you used? Bubble in all that apply.

   (a) WolframAlpha

   (b) Graph

   (c) WinPlot

   (d) Other (e.g. Fooplot, Maple, GeoGebra)

   (e) None of the above

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	Resources used by students in College Level Courses
Wolfram Alpha	24.88%
Graph	14.90%
Winplot	6.14%
Other (Maple, GeoGebra, FooPlot,etc)	27.34%
None of the above	51.77%

9. Which of the following resources available at PCC have you used? Bubble all that apply.

   (a) On-campus Student Learning Centers

   (b) Online tutoring

   (c) The Student Help Desk

   (d) Other (e.g. Collaborate or Elluminate)

   (e) None of the above

   We encourage students to use some of the resources that PCC offers such as On-campus Student Learning centers, online tutoring, student help desk, Collaborate and/or Elluminate. We found that a significant amount of students in Face-to-Face classes were using the resources whereas students enrolled in an online class were not. This is not especially surprising since the nature of online courses allows infrequent campus visits for the student. However, we could work to encourage the use of online tutoring to our online demographic.

	Percentage of students using PCC learning resources
Face-to-face	67.32%
Online/hybrid	36.08%

10. Which of the following resources do you use for your math class that is available outside of PCC? Bubble all that apply.

    (a) Private Tutoring

    (b) Math websites (such as Khan Academy, Purple Math, etc.)

    (c) Youtube videos not provided by instructor

    (d) Other

    (e) None of the above

    With the wide-spread availability of the internet, students have been increasingly using sites like Khan academy, PatrickJMT, PurpleMath, YouTube etc to supplement class time. In the absence of formal lecture, the data suggests online students using these services more than their face-to-face classmates. For others, private tutoring or help from their peers is another option.

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	Percentage of students using external web videos like Khan, PatrickJMT, PurpleMath, etc ...
Face-to-face	45.49%
Online/hybrid	56.36%

The data suggests that both Pre-college and College Level are using these resources. It isn't surprising to see these resources used more readily by College Level students based on word of mouth or more knowledge of which sites are reputable and which are not. The more math classes the student takes, the more resources they can use to assist in their learning.

	Percentage of students using some form of learning resource outside of the PCC network.
College level	79.57%
Online/hybrid	63.47%

E– Study to See if Bringing in an Online Homework System into a Distance Learning Course Aids in Retention

:sec:onlinehwstudy⟩?

1 *Overview*

During the 2012/2013 school year Wendy Fresh and Jessica Bernards ran a study in their online MTH 60 and MTH 111 courses to see if using an online homework system, instead of the traditional method of paper/pencil homework, would aid in the retention of online students. Each instructor taught multiple sections of the same course. Each course was set up almost identical in nature with the exact same lecture notes, exams, and quizzes, with the exception of the method of homework: some sections did homework out of the textbook along with 4 homework write-ups (the traditional setup), while others only used the online homework system, MyMathLab (MML), for homework with no homework write-ups. The weights of each grade category were the same in all classes and all exams were graded together.

2 *Summary of Results for the MTH 111 study*

Please keep in mind that these are low sample sizes but there are some interesting things to note:

- In the MTH 111 courses, there wasnâĂŹt a big difference between grades on exams, except for a 4% average difference in student overall final grades. However, when looking at the fail rates of the courses, the MyMathLab group had an 11% lower fail rate. Thus helping with retention.
- Additionally, in the MTH 111 courses a higher percentage of students stuck with the class until the end in the MyMathLab courses, compared to the traditional sections. Only 16% of students withdrew from the MML courses compared to 32% in the traditional courses.

3 *Summary of Results for the MTH 60 study*

The quantitative results of the study are broken down in the data tables below. Please keep in mind that these are low sample sizes but there are some interesting things to note:

- The Final Grade Average went up on average by 4.3% in each MyMathLab course.
- The Fail Rates went down on average 5.6% in each of the MyMathLab courses.

Some things we noticed in our classes that donâĂŹt show in the data:

- Students in the MML classes were much more engaged in the discussion board posts and posted more often than the traditional classes.
- Students in the MML courses asked more in depth questions about the mathematical content and asked questions more often throughout the term.

F– Accessibility study summary

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At the start of Fall Term 2011, PCC began its push to make online courses accessible. Realizing the complexity of this issue in relation to our courses in particular, the Math SAC formed a committee to begin investigating methods for making content in online math courses accessible. After a few weeks of meetings and some initial experiments, the committee realized the scope, complexity, and importance of this issue was beyond what we could do outside our regular obligations as instructors. Towards the end of Fall Term 2011 we submitted a request to administration to provide two instructors with release from teaching one class for two terms to more thoroughly investigate the topic.

Shortly before the start of Fall Term 2012, we were informed that through a combined effort of funding, administration had granted a 1-class release for one instructor for two terms. Committee members, while appreciative of the offer, were concerned that this project would weight too heavily on the shoulders of one instructor. It would not only be overwhelming for that instructor, but would also not allow the topic to be fully investigated. Having two instructors with varying backgrounds (Mac vs PC, Word vs. LaTeX, etc.), we felt the topic could be approached from multiple angles– a collaborative project would be much more successful than a solo project.

As such, we requested that instead of one instructor having a one-class release for two term, we would prefer to have two instructors to have a one-class release for one term. This would allow for the collaboration between two complementary math faculty members as well as spread the cost of the project between a greater number of budgets. The administration agreed to the revised project and Chris Hughes and Scot Leavitt both received a one-class release for Fall Term 2012. Chris and Scot met with Karen Sorensen (accessibility advocate for online classes) and Andy Freed (Manager of Technology and Support) shortly before the start of Fall Term 2012.

The initial phase of the project reoriented Scot and Chris to where they had left off from the previous year: to build off of that work, and see what technological advances had been achieved. They also realized that as they themselves were not end users of assistive technologies, they needed to meet or work with people who were; this follows the mantra "Nothing For Us Without Us." About a third of the way through the term, Keala Parks introduced them to Maurice Mines, a gentleman from Washington state who is blind and has a bit of both a technological and education background. After the first meeting with Maurice, it became clear that he would be a vital part of the project, and further enhanced the collaborative nature.

Having had many successful translations of mathematical documents into various accessible formats (printed Braille, electronic Braille file for a refreshable Braille device, webpage for a screen reader) and having successfully printed embossed/raised graphs, Maurice agreed to help Chris and Scot with an experiment. They prepared a sample lecture related to a MTH 60 topic (the slope of a line) and presented the material to Maurice in four formats: verbal presentation with the raised graphs, as a webpage that made use of JAWS (a PC-based screen reader), as a printed Braille document, and as a electronic Braille document to be used on a refreshable Braille device.

Prior to the experiment, Scot and Chris were under the impression that JAWS was THE solution to making the content in a math course accessible. Through this initial experiment they came to realize several (now seemingly obvious) truths:

1. Every blind student will have his/her own preferred way of receiving the content in a course, just as every student has his/her own learning styles.
2. There are various grades of Braille which impacts how the mathematics should be encoded into Braille.
3. JAWS is one of many possible assistive technologies available and is NOT the solution.

Through additional experiments and meetings with Maurice, they learned more than they had ever expected. More than just learning about the technologies out there (and what might be coming in the near future), they developed a personal connection to the topic. The report written at the conclusion of the project includes both a summary of our experiences, some general best practices, as well as specific recommendations for mathematics courses.

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The success of the project was based on the collaborative effort between the Math SAC, the Distance Learning Department, the respective Division deans, and Disability Services. While the math faculty members took on the majority of the work, it would not have had any success without the support of Karen Sorensen, Andy Freed, Sue Quast, Loraine Schmitt, and Kaela Parks. Over the remainder of the 2012-13 academic year, Chris, Scot, Karen, and Kaela presented the work and findings at eLearning 2013 Conference in San Antonio, TX, online to OCCDLA (Oregon Community College Distance Learning Association), and the Spring 2013 ORAHEAD Conference in Corvallis, OR.

The experience gained in this work continues to inform decisions made within the Math SAC, especially those that concern textbook selection, and the choice to pilot new technologies. It has further enhanced our understanding and awareness of the diverse nature of our student body at PCC.

G– ALEKS pilot

?⟨app:sec:aleks⟩?

1 *MTH 20 Several classes during 2012–2013 AY (Edwards)*

The pilot includes the extensive use of ALEKS, a technology based assessment learning system, in 2 on campus and 2 online classes each term.

Course logistics:

- Students are walked through an introduction to the system and given an assessment
- Students are then provided with a very clear visual pie chart showing them what they know.
- ALEKS then provides students the opportunity to work on a range of instructor chosen topics at their current level. Student only work on concepts they have not mastered.
- Explanations and videos are provided with each topic.
- Students are provided instant feedback and instant online teaching
- Students are not given the option to skip work that they have not mastered, essentially forcing them to learn the material and fill in the concepts gaps that they began the class with.
- Students are routinely assessed with new topics available as they move through the course.
- Students are in the computer lab working on ALEKS throughout the class period
- Students, (generally for whom the material is recent) have the ability to move ahead.

Results and Statistics

Reflecting only fall term math 20 students. This was a definite pilot. A variety of changes were incorporated into winter and spring terms. Including additional lectures and assignments that had each class more closely resemble more traditional class.

- Students loved the instant feedback
- Students enjoyed the ability to work in the ALEKS system, choosing their topics, and getting ahead when desired. There were very, very few complaints about the system.
- Students became aware of how much time they studied, with a clear visual of the relationship between study time and learning.
- FOUR students last term completed the math 20 material, moved on to math 60 material, took and passed my math 60 final exam.

On Campus Classes:

- 78% of students passed math 20 last Fall compared to 89% using ALEKS (7am class result was 63% passed using ALEKS)

- Of those that went on to math 60: 60% passed last Fall compared to 69% using ALEKS (7am class result: 13% passed, 1 in 8)

DL Classes:

- 62% of students passed math 20 last Fall compared to 71% using ALEKS
- Of those that went on to math 60: 61% passed last Fall compared to 46% using ALEKS.

2 *Pilot in Math 112 during Winter 2013 (Louie)*

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I think the most beneficial part about ALEKS is the instant feedback and instant teaching. This gives the student a chance to fill in the holes of their knowledge. My data was from a very small group. I compared one class (no aleks) to 2 classes (with classes). I averaged data from the 2 classes to get more accurate results. Surprisingly the grade distribution and overall pass rate was very close from ALEKS to no ALEKS. The distribution of grades was also very similar. In both classes my pass rate was 73% which is well above the current 57% campus average pass rate. The attrition rate for non ALEKS classes was 32%. The ALEKS class averaged a mere 14.7%. Does ALEKS keep students on task and less likely to withdrawal from the course? The numbers seems to support it but the sample size was small. The other benefit to ALEKS is requiring students to do homework and keeping track of their progress. The max average time spent on ALEKS was 15.4 hours and the minimum 1.6 hours per week. Despite my lack of data to support higher grades, I am confident that the students should be more prepared for Math 251. I am planning to check the success rates of the students who went on to calculus at Cascade campus. I would like to see if the pass rate of ALEKS students is higher than that of NON-ALEKS courses. Data is still in the works.

Best of all, students were forced to complete ALL homework and lectures seemed to flow with little interruption. I have not completely compiled the results from an ALEKS survey I gave at the end of the term. However the beginning results favor that most students enjoyed using ALEKS for homework and found it helpful in their learning.

H– Enrollment summaries (by term and campus)

?⟨sec:app:enrollment⟩?

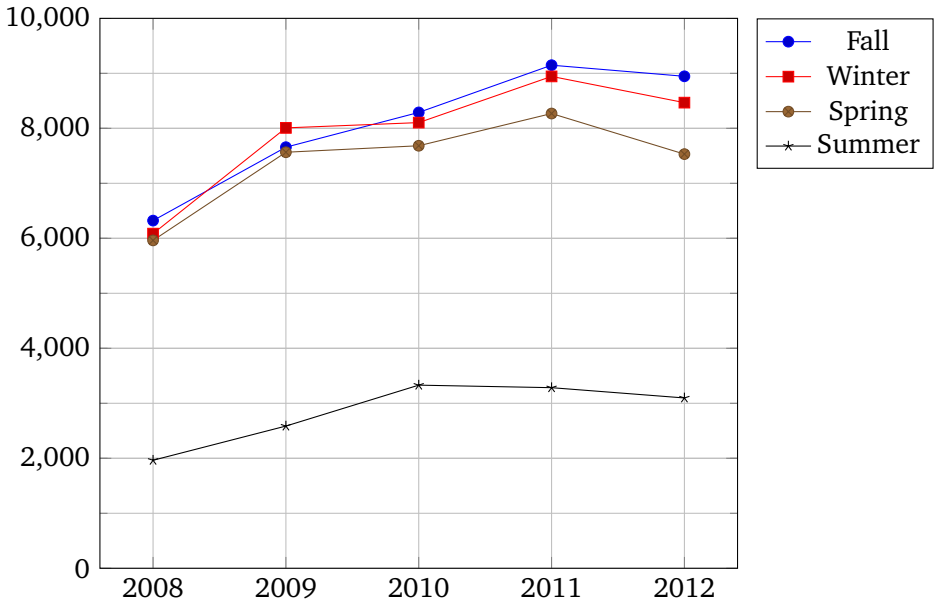

Figure H.1: Enrollment in Developmental MTH by Term

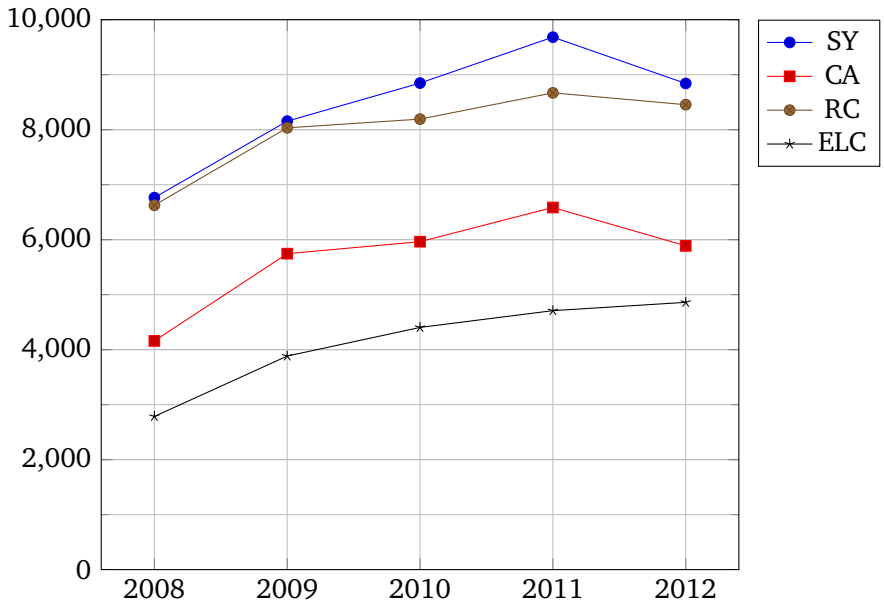

Figure H.2: Enrollment by campus and year, College Wide, Developmental Math

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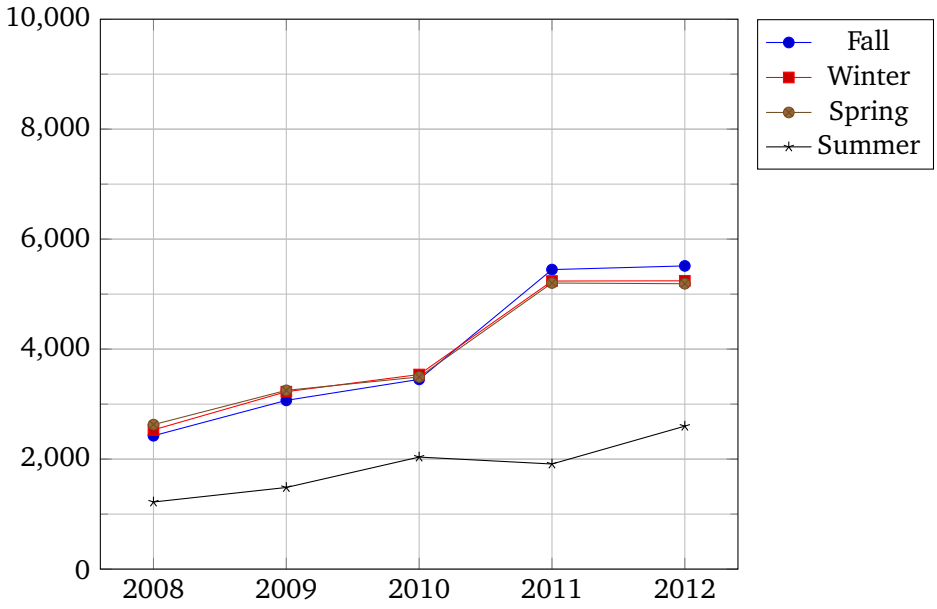

Figure H.3: Enrollment in LDC by term

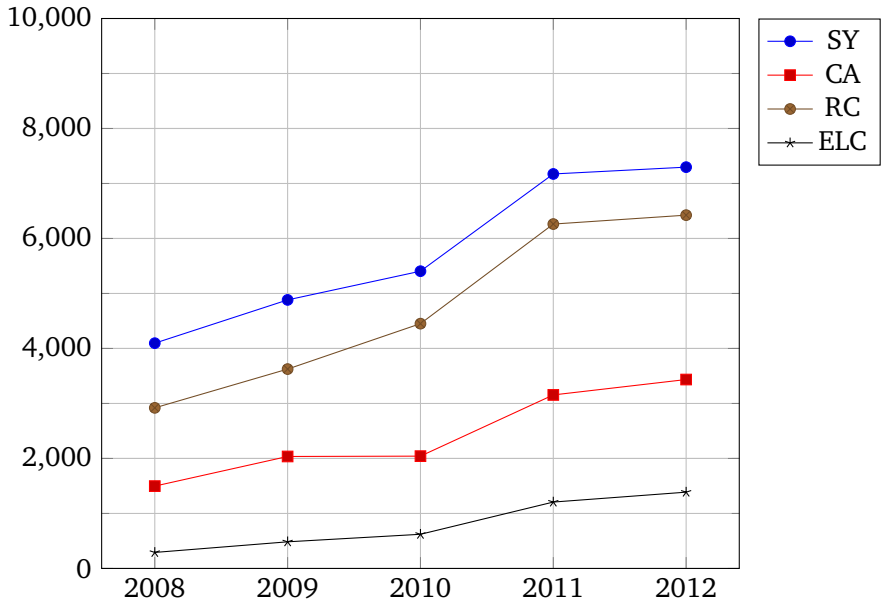

Figure H.4: Enrollment in LDC MTH by campus

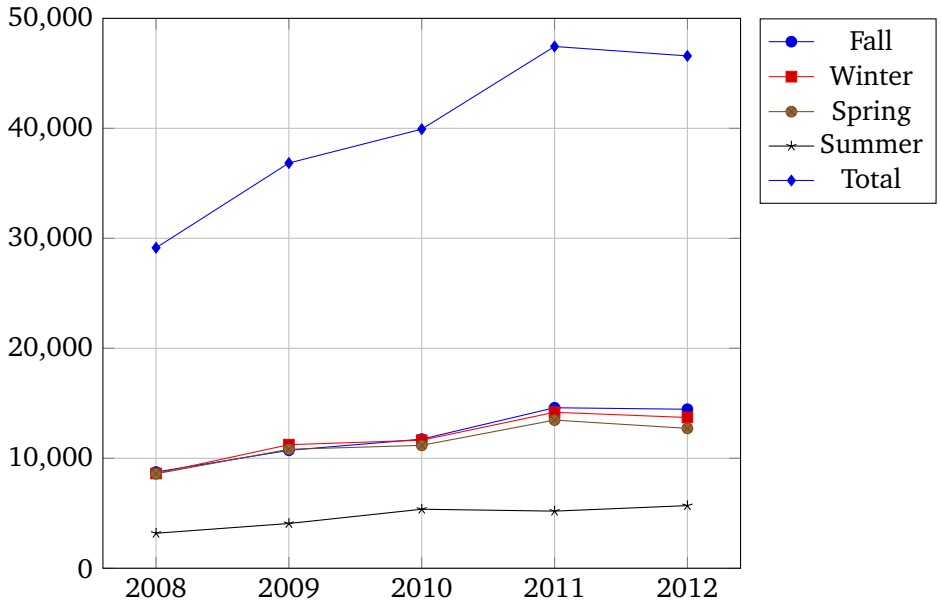

Figure H.5: Combined Math enrollment by term and year

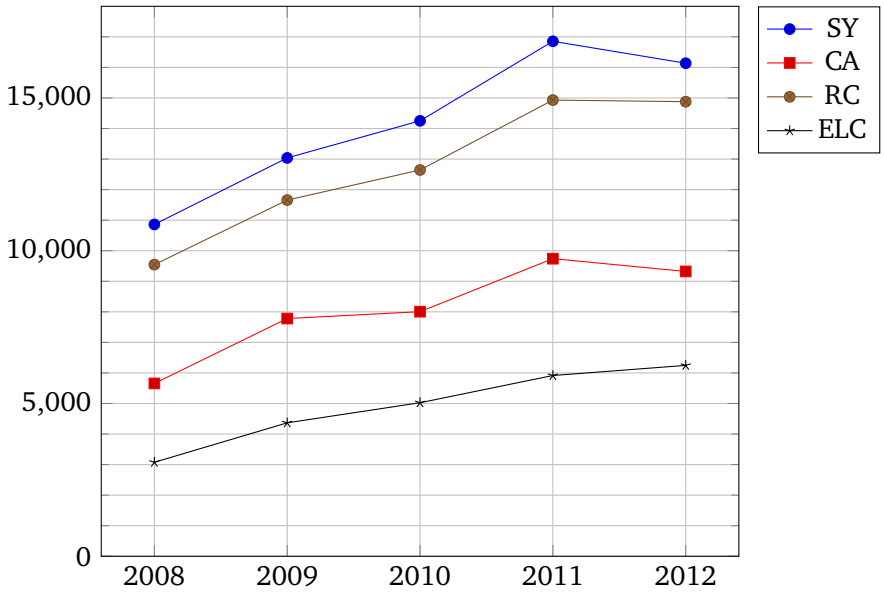

Figure H.6: Enrollment trends by campus (combined MTH)

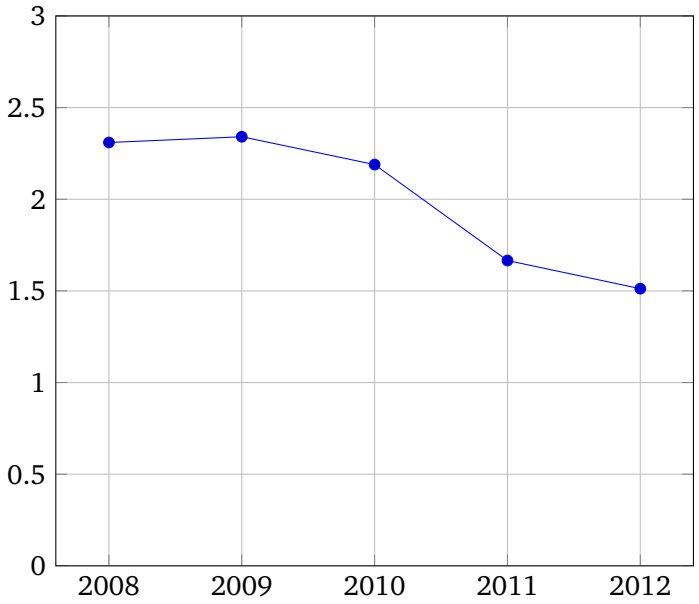

Figure H.7: Ratio of Developmental MTH enrollment to LDC MTH enrollment

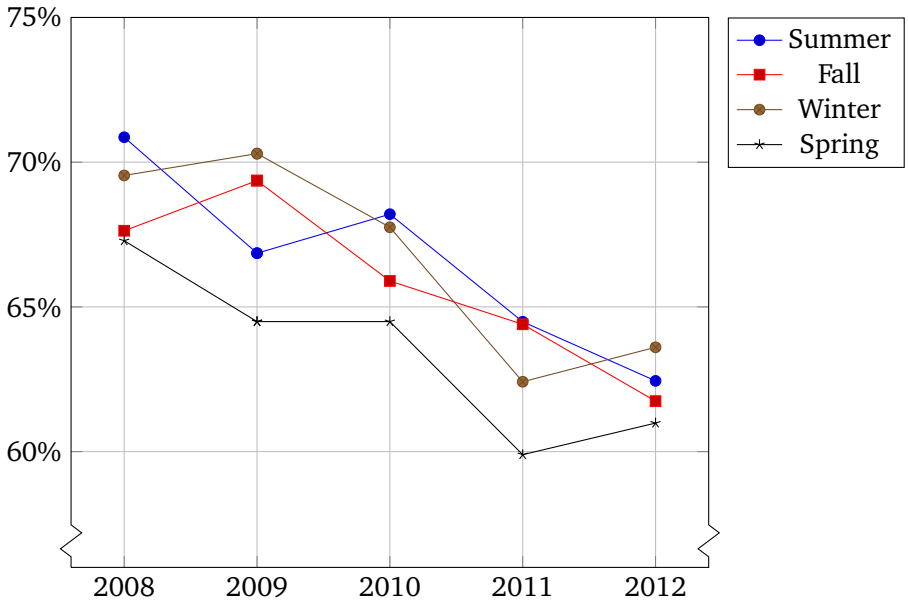

Figure H.8: Success rates by year and term