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 14.1% of PCC math enrollments were into a DL class during the academic year of 2012/13 compared to only 9.1% in the 2007/08 academic year. This percentage increase is coupled with a general enrollment surge over the past five years, and the number of DL enrollments has grown by over 150% in this time period. Table 1.2 shows student enrollment in face-to-face courses compared to online courses over six academic years.

As enrollment demand for DL math courses has increased, we have increased the number of sections that we offer and trained more interested faculty in managing DL courses. Between the academic years of 2003/04 and 2007/08, the annual number of sections offered increased from 51 to 87. In the 2012/13 academic year, we offered 185 DL sections. The resulting increase in sections offers access to students that can succeed in this modality and need this option due to outside constraints such as work and family. FIX

⟨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, 060, 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

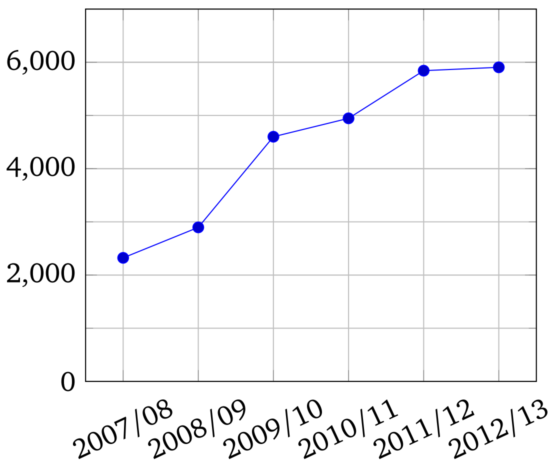

FIGURE 1.1: Enrollments in DL

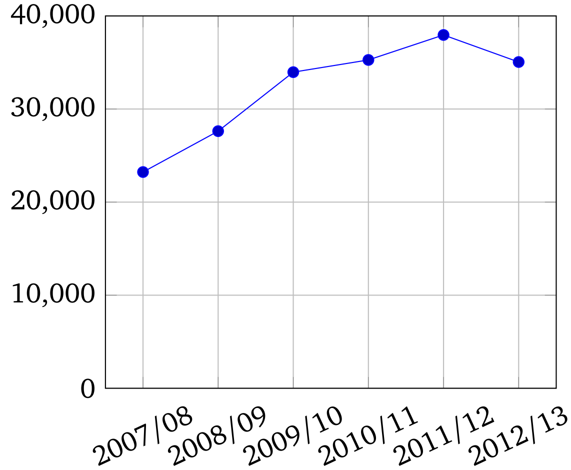

FIGURE 1.2: Enrollments in F2F

TABLE 1.2: Table Caption goes here

F2FandDLenrollments⟩

Success Rates in DL courses

Pass rates in DL courses are quite noticeably lower than those for their face-to-face counterparts. Figure 1.3 shows the difference in pass rates between the DL courses that we offer and 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. 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 . 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.

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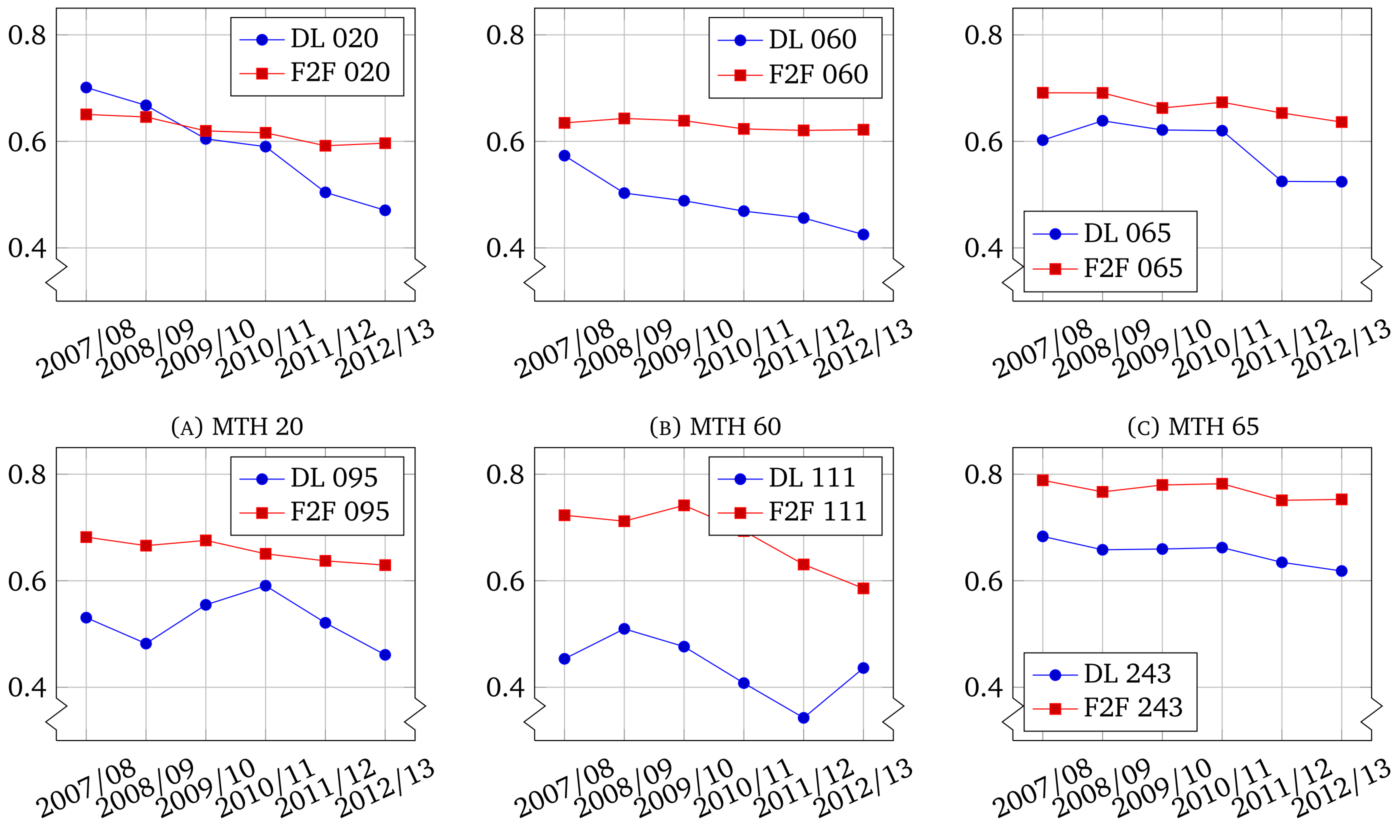
The difference in student-success rates between on-campus courses and DL courses is an important issue for the Math SAC. The Distance Learning Standing Committee has met to consider this issue and the factors that lead to this difference in success rates. We can only speculate the reason for the disparity 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 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



(A) MTH 20 (B) MTH 60 (C) MTH 65

(D) MTH 95 (E) MTH 111 (F) MTH 243

FIGURE 1.3: Pass Rates By Modality

g:sec3:F2FandDLpassRates⟩

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 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.

The SAC recognizes that program changes should come from research toward best practices. Faculty members Wendy Fresh, Rebecca Ross, Tammy Louie, Jessica Bernards, and Diane Edwards have investigated the effects of use of an online homework system in several experiments (in both DL and F2F courses). In most cases, results from these experiments suggest there may be positive effects to using an online platform, but it remains too early to declare statistical significance. To demonstrate statistical significance in studies of this nature requires considerably large sample sizes.

However Jessica Bernards has been able to measure one positive effect to a significant degree. Instructor Bernards taught several online sections of MTH 111, with control groups doing homework from the textbook and submitting paper write-ups, and experimental groups using online homework. The withdrawal rate was 32% for the control group and only 16% for the experimental group, and this difference was statistically significant ($P < 1\%$). Instructor Wendy Fresh ran a very similar experiment with online sections of MTH 60. There may still be an effect at that level, but more data is necessary to confirm with statistical significance. Both instructors noted modest improvement in exam scores among the experimental group, but again more data is being gathered to confirm with significance.

For more information on research by Instructors Bernards and Fresh, see appendix F. For information on research by instructors Edwards and Louie, see appendix H.

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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 2014 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 Dr. Jordan. This partnership between two Oregon state institutions has been mutually beneficial.

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. 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. 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.

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TSS partnered with the Clackamas Education Service District to deliver a WeBWorK server that will be fully implemented in winter 2014. SAC members Alex Jordan, Chris Hughes, and Xiaolong Yao are preparing webwork.pcc.edu for regular use during the winter 2014 term. A backup server at webwork-dev.pcc.edu is 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. The SAC should work with advising to implement this.

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 Dr. Jordan had laid in previous years. Jordan, Hughes, and Yao presented their work at the STEM showcase (Rock Creek) in Fall 2013 . It was at this showcase that the idea was hatched to create free online homework review programs for CTE and LDC science SACs.

FIX

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. However it is necessary if any instructor hopes to use WeBWorK as a teaching tool and not just an assessment tool.

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 seen in Figure 1.3. 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 must come mostly 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 would 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.

For the Math SAC

- Collaborate with advising to implement a WeBWorK-based review mechanism for would-be placement test-takers.

- Consider how the quality of online courses could be regulated more.

For Administration/Advising

- Collaborate with the Math SAC to implement a WeBWorK-based review mechanism for would-be placement test-takers.

- Give students more information on DL responsibilities and make students aware of the difference in student-success statistics between DL and face to face courses.

- 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.

For Administration/DL/TSS

- 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.
- 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.
- Include a pop-up or hover-over window that is activated when a student tries to register for a DL MTH class that gives specific information about the challenges of DL Math courses.

For Administration/Other

- 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.
- Provide opportunity for faculty professional development in research design and data analysis to help with research efforts on the efficacy of online homework.
- Provide support for further development of WeBWorK related projects, including a larger library of math problems for courses beyond 60/65/95, enhancements of the WeBWorK engine, and content for placement advising/review.

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 2012 (12 students), Winter 2013 (22 students), Spring 2013 (15 students), and Fall 2013 (17 students). Ronda Lively was the instructor the first three terms, which allowed her to evolve her materials and activities. Ann Cary is teaching the Fall 2013 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. Instructor 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 it 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. For a sample of material from this workgroup, see appendix N.

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.

Placement Test Reform Group

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 2012/13 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:

- 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.
- A two-day mandatory summer workshop was 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.
- A Google Drive site was created 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 2013/14 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 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).

2
Needs of Students and the Community

A.

How is instruction informed by student demographics?

In order to answer this question, we decided that we needed a definition of demographics beyond the normal categories that are provided by the college. We came up with age, sex, gender, race, creed, sexual orientation, learning ability, educational background, and socio-economic status.

Our instruction is informed by these student demographics in a variety of ways.

Social Justice (Addresses Socio-Economic Status, Race, Gender)

The Math SAC has a social justice workgroup that was formed in 2012. Their objectives are to explore and discuss issues relating to diversity within the mathematics classroom as well as to create projects, activities, and other course content related to issues surrounding social and environmental justice.

Examples of these projects and exercises include: a fine in Yonkers, NY related to segregation for MTH 111; racial profiling in traffic stops; gentrification in Portland; and the Deepwater Horizon Oil Spill. Many of these projects were adapted to fit various mathematical levels from MTH 20 to MTH 252. Problems were also generated for MTH 243, using gun violence and international prison data. For more detail, see appendix N on page 41.

Individual Faculty Awareness

A recent survey of MTH faculty asked if they had ever modified instruction to meet our diversity goals. The survey used our previous program review's definition of diversity, which was:

> *We will enrich the educational experience by committing to the development of diversity in our student body, faculty and staff.*

Here are some highlights and themes from the survey responses. One faculty member mentioned that

> *I have been learning about Complex Instruction, which has helped me attend to status in my classroom. Who has high status and who has low status? Complex Instruction (CI) provides opportunities to highlight the diversity of ways to be smart in a mathematics classroom... so that all students can participate equally in the classroom activity.*

Another SAC member is dedicated to educating herself in the classroom,

> *If there is a cultural barrier, my awareness and appreciation of diversity enables me to want to learn about the unfamiliar, and educate about my own. My immense experience working in diverse settings with unique individuals constantly increases my*

awareness of what I can do to make someone fell comfortable and what I need to do to accept individuality without enforcing conformity.

Many of our faculty commented on the use of group work as a way to expose students to diverse ideas and culture. They also indicated that they tried to be culturally aware when writing application problems by choosing different names, genders and roles for the characters in their problems. The 'Rule of Four' (functions and relations should be presented numerically, graphically, verbally and symbolically) is incorporated into most of our CCOGs. The rule of four recognizes and highlights the different ways people prefer to learn mathematics.

Educational Cost (Addresses Socio-Economic Status)

Our SAC is aware of the cost of course materials and considers the socio-economic status of our student population when selecting texts.

The SAC has a long-standing policy to require the same textbook for all sections of a course. Since PCC has such a large student body and we offer many math classes, this policy has enabled the math SAC to negotiate wholesale prices of textbooks (particularly custom editions) with publishers. This saves students money when taking a sequence course (for example MTH 60/65) and allows students to sell back their book to the bookstore.

Publishers can create a custom edition from an existing textbook by removing material (e.g., chapters) or adding material (e.g., supplemental materials); the publisher labels the textbook 'A Custom Edition for Portland Community College', and thus restricts its resale value, as it can only be used at PCC; this benefits the publisher and enables them to reduce the price to PCC.

Math SAC subcommittee have successfully implemented this idea with the textbooks for almost all of the mathematics classes taught at PCC: MTH 20, the MTH 60/61/62/63/65 sequences, MTH 95, MTH 111, MTH 112, MTH 105, MTH 243/244 sequence, and the MTH 251/252/253/254 sequence.

In addition to using custom editions uniformly across the district, we have a group that is investigating an in-house Pre-Calculus text to reduce dependency on publishers. The group is inactive at this point because they have been unable to secure funding or release time

We actively pursue free and open source products such as WeBWorK– the only fully accessible online homework system . This meets our goal of providing low cost curricular materials and also supports student access. The University of Oregon has generously hosted several WeBWorK courses for PCC over the past few years. Disability Services has provided strong support for WeBWorK, and we were able to procure our own WeBWorK server at PCC in the Fall of 2013.

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Educational Background

We have several projects and classes in place to address our students' different educational backgrounds.

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STUDY SKILLS

The Study Skills program was created to address the different educational backgrounds of our students, particularly those students who have underdeveloped study skills. This program consists of seven topics all relating to study skills specific to mathematics: how learning math is different, resources available for help at PCC, time management, listening and note-taking skills, why and how to do homework, test taking strategies, and how to overcome math and test anxiety. Each lesson is broken up into three parts: a short video to be watched by students outside of class, a student worksheet to be completed in conjunction with the video, and an in-class discussion lead by the instructor.

AMP MTH 07/08 (also known as AMP) addresses differences in educational backgrounds. It allows students who have previous exposure to the material to attempt to move to a higher level class (see appendix L on page 39).

Even with the above mentioned programs, we feel that the college could do a lot more when it comes to placing students into classes appropriately and orienting them to the demands of college. We would like to see more wrap-around services for students in developmental classes. These services would ideally begin before the students steps into the classroom. We suggest the adoption of a placement test that measures study skills, motivation and academic preparedness.

We recommend that students who are not academically prepared be required to take a study skills course. We would like to see more math-specific advisors and have enough advisors so that it is feasible for a student to see an advisor every term. We would also like to see the tutoring center open during the first week of the term. In our experience, students who are behind during the first week have a hard time catching up.

Data Trends

Despite the above mentioned efforts to have instruction informed by our student demographics, we have still found that there is an achievement gap when it comes to minority and under-represented populations. We have displayed data for five years in appendix P on page 67; see Tables P.1 to P.10. PCC has undergone vast enrollment changes over the last five years since our previous program review; here are the trends that we observed for this time period:

- The percentage of both White and Asian students increases as students progress through the sequence of MTH classes. There appears to be a modest increase in diversity levels in MTH 251-254 over the last 5 years, but this may be due to more students identifying as Multiracial.
- There is slight increase in diversity since AY 2008 (the percentage of students who identify as white has decreased in most of our courses).
- There is a shockingly high numbers of students aged 19 or less who place into MTH 20. Since many of these students should have been exposed to the material recently, we need to further examine both the placement exam and our communication with high schools. For example, are high schools allowing students to use calculators too freely? Are students who are otherwise proficient at algebra placing low due to not understanding fractions? This is something that needs further investigating. If we could decrease the number of young students placing into MTH 20, we might be able to shorten their path to a degree.
- The percentage of students aged 50+ decreases through the DE sequence. We suggest intentionally creating support systems for 50+ students, particularly in MTH 60. These students likely have been out of the educational system the longest, so they face different challenges than their younger peers.
- There is a large decrease in the percentage of black students from MTH 20 to MTH 60. Not only is there a percentage decrease, there is also a decrease in the total number of black students in MTH 60 compared to MTH 20. This indicates that MTH 20 is likely a significant barrier to some minority students or that minority students place into MTH20 at a disproportionately high rate. Although this is relatively consistent with national data, we would like the administration to continue to support programs like Passages and other measures to increase success rates of minority students. In addition, a more diverse faculty might help with retention and passing rates.
- The pass rates for black students are noticeably lower each year and in each course. We suggest intentionally creating support systems for black students studying mathematics.

- Females consistently pass MTH 20/60/65/95 at higher rates than males, but a smaller proportion of females enter MTH 112. We suggest identifying barriers to females continuing on to MTH 112 and related careers. However, we also realize that there are larger cultural and societal trends at play here.
- Female students are underrepresented in MTH 112, and 251-254 as noted above. However, it appears that many female students take a statistics route instead of a calculus route.
- The percentage of men passing MTH 20 is lower than that of female students. In addition, it appears that the percentage of males enrolling in MTH 20 is increasing (perhaps due to the economic downturn). This is consistent with data at the secondary level. Since MTH 20 is pre-algebra, some of this may be due to prior educational experiences and students attitudes of their ability.

B. *Have there been any notable changes in instruction due to changes in demographics since the last review?*

At Cascade, the number of MWF classes has increased since the last program review. This was done in response to the increased demand for MTH 61/62/63. The increase in these classes seemed to coincide with a large influx of underprepared students who returned to school after the recession.

Classes that run three days a week are designed to help students who struggle with the demands of a two-day-a-week class. While there isn't a notable difference in success rates between MWF classes and those that meet less frequently, it is felt that the shorter class time is better for students cognitively, their attention span is held longer and students engage in more frequent practice of mathematics.

We would like to see more MWF or even MTWTh classes to provide more flexible scheduling options for the benefit of students. We suggest that one way to accomplish this is to turn more MW classes into MWF classes.

C. *Describe current and projected demand and enrollment patterns. Include discussion of any impact this will have on the program/discipline.*

Demand and enrollment patterns have been divided into two categories: Developmental and Lower Division Transfer Mathematics.

Developmental Mathematics

Enrollment in pre-college courses increased from AY2008 to AY2011 by 46%. There was a slight decrease (5%) in enrollment from AY2011 to AY2012 (see Figure 2.1, and its counterpart by campus in Figure I.2 on page 33 in appendix I).

In particular, enrollment in Developmental mathematics courses increased most significantly at CA and SEC. Enrollment in Developmental mathematics courses decreased from AY 2011 to AY 2012 at all campuses except SEC. In many cases, sections were cut in 2011-2012 due to a lack in facility space– see Table 2.1.

FIX

Lower Division Transfer Mathematics

FIX

Enrollment in Lower Division Collegiate (LDC) courses increased over the 5 year period of this Program Review, but at a decreasing rate. There was a 36% enrollment increase from summer 2011 to summer 2012. We suspect this is due to changes in financial aid eligibility. Prior to this

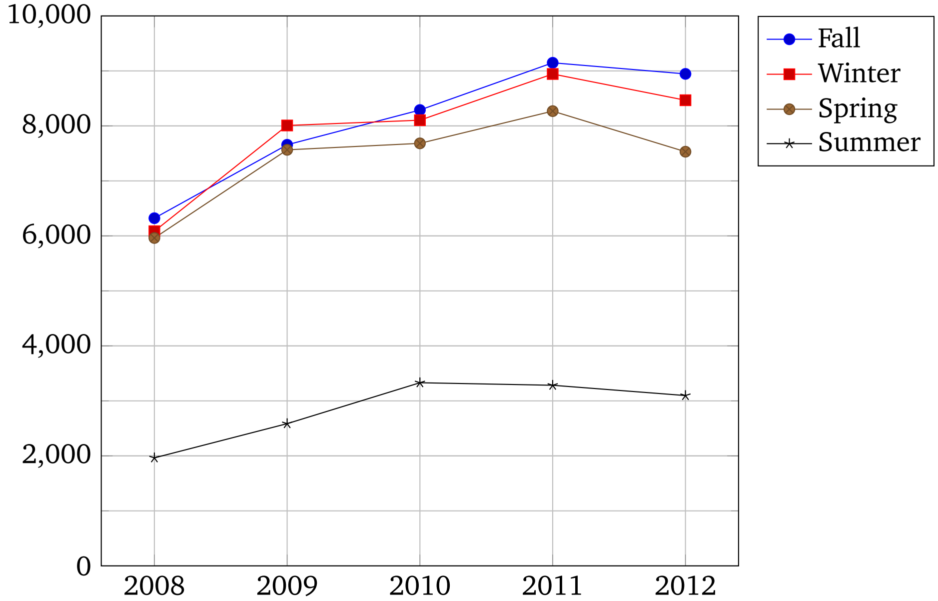

FIGURE 2.1: Enrollment in Developmental MTH by Term

rollmentDevelopTerm⟩

TABLE 2.1: Developmental Mathematics by Campus

ab:enrollmentDevelp⟩

	AY2008	AY2009	AY2010	AY2011	AY2012	% change 2008-2011	% change 2011-2012
SY	6764	8155	8847	9682	8840	43.14%	-8.70%
CA	4159	5745	5963	6585	5887	58.33%	-10.60%
RC	6625	8033	8192	8669	8454	30.85%	-2.48%
ELC	2785	3883	4404	4709	4860	69.08%	3.21%

change, students were awarded financial aid for fall, winter, and spring, and needed a separate application for summer term. After the change in eligibility, students were awarded aid for an entire academic year, commencing with summer term 2012. This increase in enrollment is shown in Figure 2.2 with its per–campus counterpart in Figure I.4 on page 34.

In particular, five-year enrollment increases in LDC are large at all campuses, as shown in Table 2.2. We expect the increase would be larger at SY if not for lack of facilities space. A lot of this growth is in the Calculus sequence.

TABLE 2.2: LDC enrollment by campus

LDCenrollmentCampus⟩

	AY2008	AY2009	AY2010	AY2011	AY2012	% Increase 2008-2012
SY	4096	4883	5405	7173	7297	78.15%
CA	1497	2036	2042	3155	3435	129.46%
RC	2920	3625	4451	6262	6424	120.00%
ELC	291	484	621	1207	1387	376.63%

Totals (Developmental and LDC Combined)

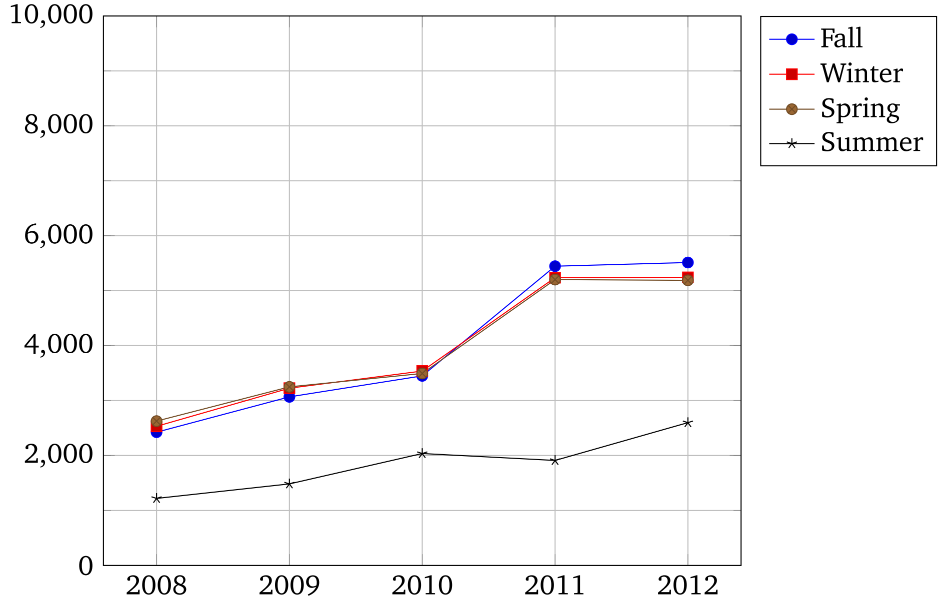

Figure 2.2: Enrollment in LDC, College Wide, by term

eds:fig:enrollmentLDCTerm⟩

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:

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” FIX

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”

B
Core Outcomes Mapping

?⟨sec:app:coreoutcomes⟩?

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

Distance Learning Successful Completions

?⟨app:sec:dlsuccess⟩?

Data represent Fall 2011, Winter 2012 and Spring 2012 courses taught both on-campus and through distance learning; courses enrolling fewer than twenty students are excluded.

The following is an overview of success rates in courses taught through distance learning. All delivery methods (i.e. online, TV/Web, etc.) are combined as 'distance learning' with courses delivered online representing the majority of instruction.

The average pass rate (grades A, B, C, P) of distance learning credit courses is 69.5%. Career technical education and lower division transfer DL courses have similar pass rates of 72% and 70%, while developmental education DL rates average less than 50%. These statistics are based on hundreds of DL courses enrolling thousands of students.

Course level data reveals variations in success rates that are not obvious in college wide averages. The following tables highlight some examples. Table D.1 shows some courses that have high success rates, and Table D.2 highlights some examples that have low success rates.

TABLE D.1: Sample *high* success rates

lsuccess⟩

	Course	DL Enrollments	% Pass %
CA	PL 224	28	100.00%
CA	AD 270b	32	100.00%
CA	FP 122	37	100.00%
CA	PL 103	55	95.00%
CA	FP 202	32	94.00%
RC	MUS 105	85	93.00%
SY	BA 206	76	92.00%
SY	GS 108	35	91.00%
SY	WR 227	144	90.00%
SY	BA 212	163	90.00%

TABLE D.2: Sample *low* success rates

⟨app:tab:lowdlsuccess⟩

	Course	DL Enrollments	% Pass %
SY	MTH 111	103	16.00%
SY	MTH 95	50	16.00%
RC	CHLA 201	97	31.00%
CA	MTH 20	132	35.00%
CA	CG 140A	80	35.00%
RC	MTH 111	235	36.00%
RC	MTH 112	60	37.00%
SY	MTH 70	137	37.00%
RC	BA 250	42	38.00%
RC	MTH 60	236	39.00%

E

DL survey summary

ec: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

FIX

	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.

FIX

	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%

F
Do online homework systems aid retention?

⟨app: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.

G
Accessibility study summary

:sec:accessibility⟩?

FIX

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. FIX

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.

H
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)

FIX

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.

I

Enrollment summaries (by term and campus)

⟨sec:app:enrollment⟩

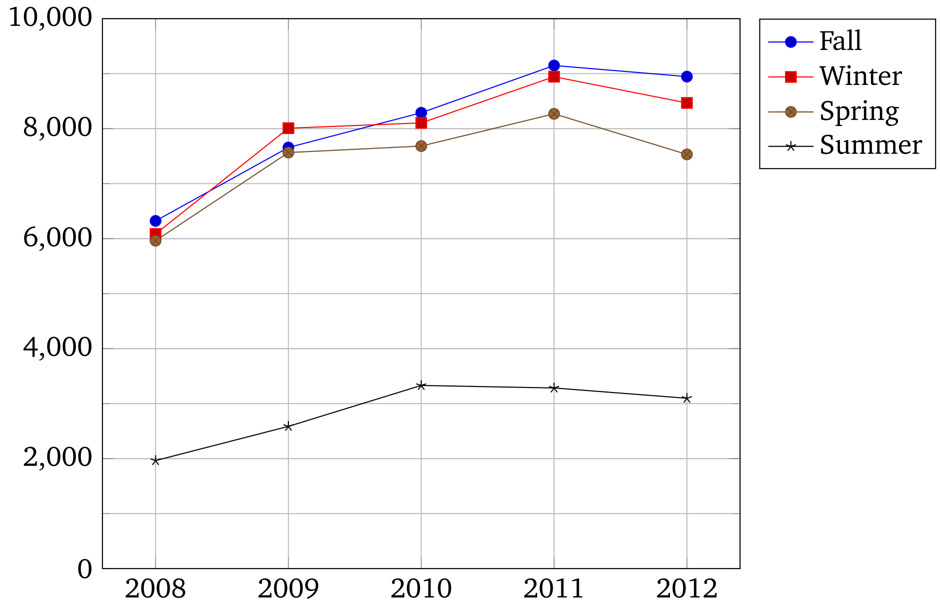

FIGURE I.1: Enrollment in Developmental MTH by Term

FIX

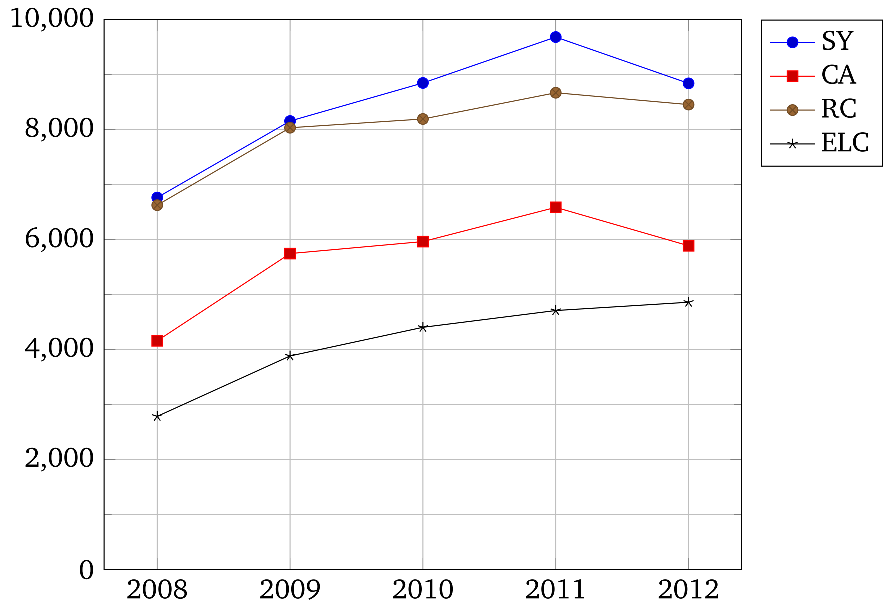

FIGURE I.2: Enrollment by campus and year, College Wide, Developmental Math

g:enrollmentDevelopCampus⟩

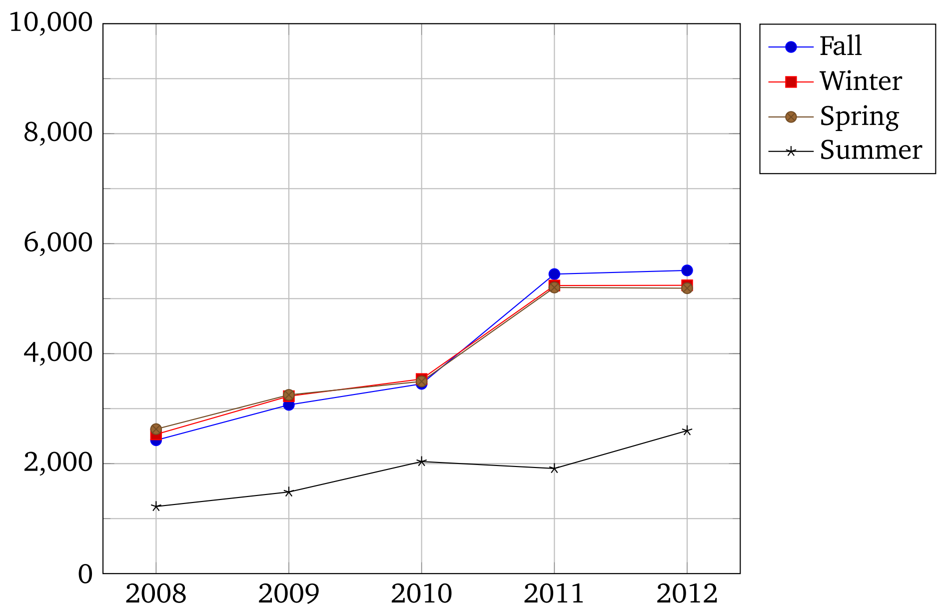

FIGURE I.3: Enrollment in LDC, College Wide, by term

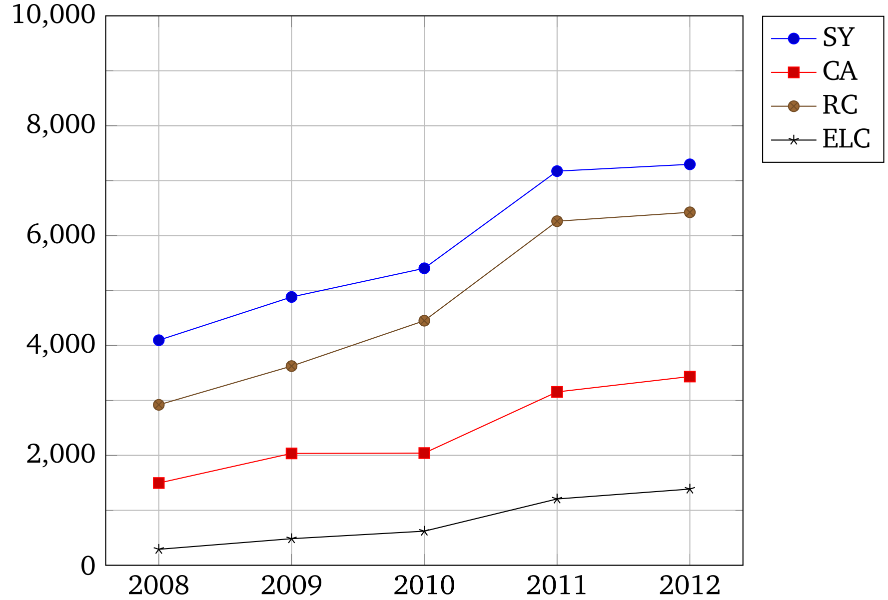

FIGURE I.4: Enrollment in LDC MTH by campus

enrollmentLDCCampus⟩

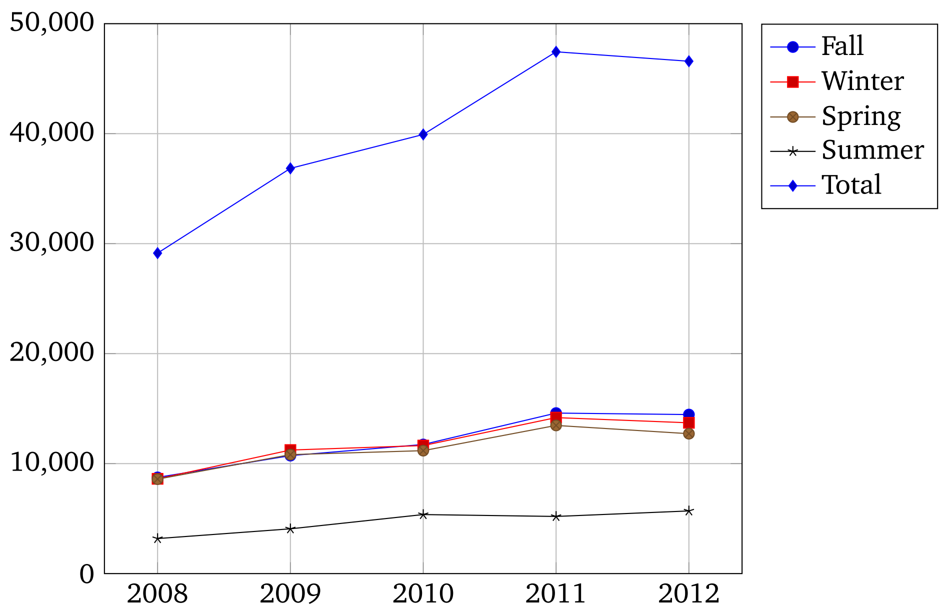

FIGURE I.5: Combined Math enrollment, College Wide, by term and year

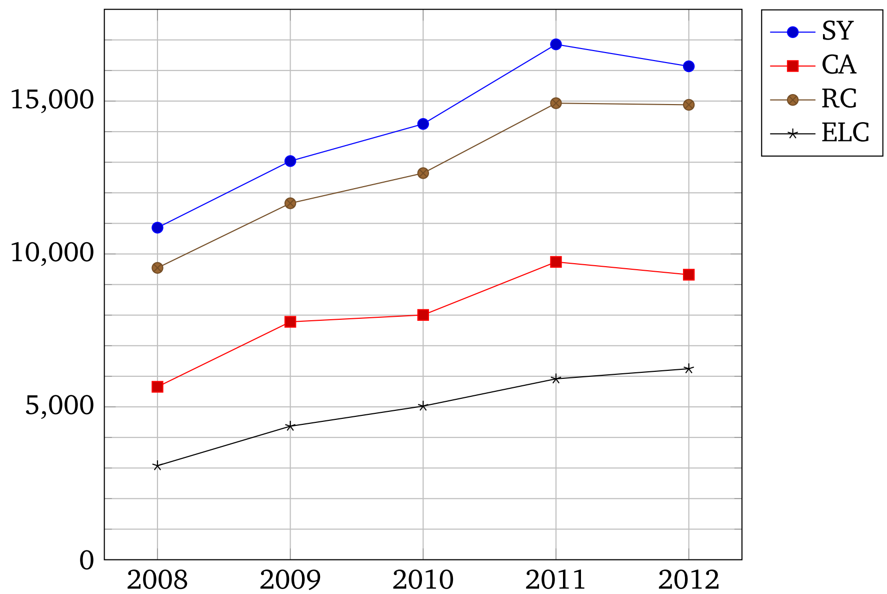

FIGURE I.6: Enrollment trends by campus (combined MTH)

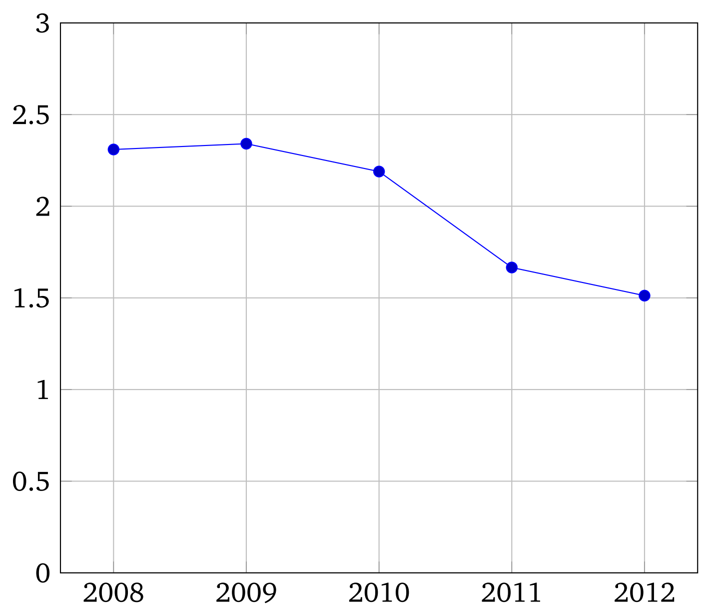

FIGURE I.7: Ratio of Developmental MTH enrollment to LDC MTH enrollment

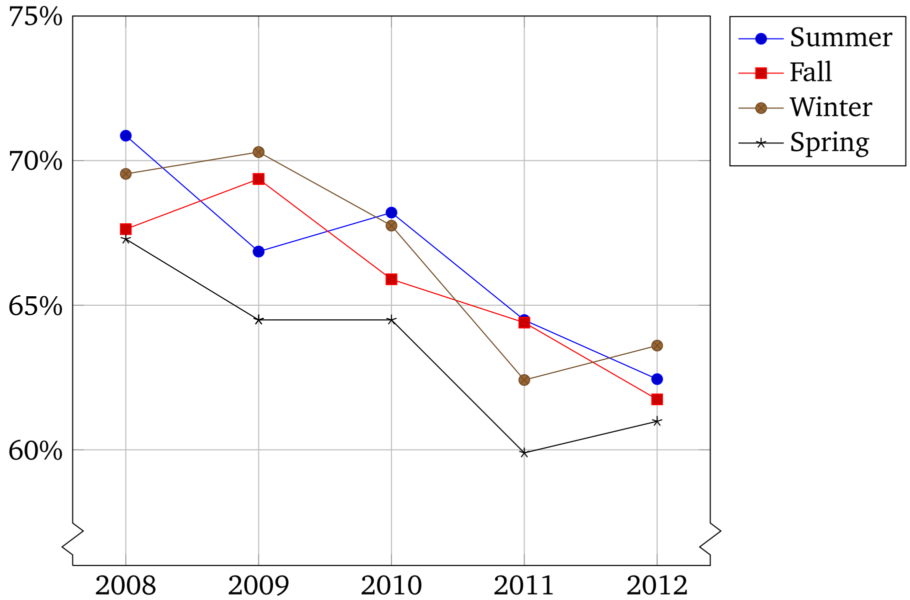

FIGURE I.8: Success rates by year and term

J

Analysis of sections taught by campus

?⟨app:sec:analysisPTFT⟩?

TABLE J.1: Summary of sections taught (by campus) from Summer 2011–Spring 2013 FIX

?⟨app:tab:analysisPTFT⟩? FIX

		Below 100 level	Percentage	Above 100 level	Percentage	Total	Percentage
Cascade							
	Full-Time	88	20.5%	62	35.6%	150	24.9%
	Part-Time	341	79.5%	112	64.4%	453	75.1%
	Total	429		174		603	
Sylvania							
	Full-Time	132	20.5%	171	42.9%	303	29.1%
	Part-Time	511	79.5%	228	57.1%	739	70.9%
	Total	643		399		1042	
South East							
	Full-Time	65	22.6%	26	41.9%	91	26%
	Part-Time	223	77.4%	36	58.1%	259	74%
	Total	288		62		350	

K
Faculty Educational Degrees by campus

sec:facultyDegrees⟩?

Table K.1 shows the highest educational qualifications of full-time and part-time faculty at each of the campuses.

Table K.2 shows the faculty turn over from Summer 2011–Spring 2013.

FIX

TABLE K.1: Faculty Education (Highest Degree)

:tab:facultyDegrees⟩

		Bachelor's Degree	Master's Degree	Doctorate
Cascade	Full-Time	0	8	0
	Part-Time	20	25	1
Sylvania	Full-Time	0	16	2
	Part-Time	16	34	1
Rock Creek	Full-Time	0	10	2
	Part-Time	14	50	4

TABLE K.2: Faculty Turnover from Summer 2011–Spring 2013

tab:facultyturnover⟩

				Reason					
		Joined	Left	FT Retired now PT	FT teach elsewhere	FT non-teaching	FT other PCC campus	PT other PCC campus	Stay home with kids
Cascade	Full-time	3	5[1]	1	1		2		
	Part-time	16	10[2]		1	1		2	
	Total	19	15						
Sylvania	Full-time	3	3	3					
	Part-time	8	6		2	1		2	1
	Total	11	9						
Rock Creek	Full-time	4	3	1			2		
	Part-time	29	19					6	
	Total	33	22						

[1] includes 4 FT temps and 1 FT permanent

[2] reasons for leaving often unknown or don't fit into these categories

L
AMP Data Collection

⟨app:sec:ampdata⟩ Cascade Campus data from AMP sections offered since 2010.

- Among students that took both a pre– and post–AMP test, 92% had an increased math compass score; 55.7% were placed at a higher math–level course.
- For students at the MTH 20 level who took the post–AMP test, 78.4% of students passed MTH 20, versus 62.8% of students who did not enroll in the AMP class.
- For students at the MTH 60 level who took the post–AMP test, 65.9% of students passed MTH 60, versus 61.6% of students who did not enroll in the AMP class.
- For students at the MTH 95 level who took the post–AMP test, 66.3% of students passed MTH 95, versus 64.4% of students who did not enroll in the AMP class.

M
Effectiveness of Self-paced Math (ALC 61, 62, 63)

c:effectivenessALC⟩?

Table M.1 provides the pass rate for other Math courses that ALC Math students enrolled in pre–ALC and post–ALC. Enrollment in some math courses for ALC students was low. However, the courses with the highest enrollment were MTH 20, MTH 60, MTH 65 and MTH 95.

This comparison of Math courses taken pre and post-ALC Math suggest that ALC Math had a positive impact on a student's ability to pass other Math courses, increasing the pass rate from 38% to 52%.

TABLE M.1: Pass rates for ALC Math students in other Math Courses

ab:effectivenessALC⟩

	PRE-ALC Math		POST-ALC Math	
	Frequency	Percent	Frequency	Percent
Math 20	47	44.00%	26	52.00%
Math 30			1	50.00%
Math 60	21	27.00%	35	54.00%
Math 61	3	60.00%	9	53.00%
Math 62	1	25.00%	3	43.00%
Math 63	1	100.00%	1	100.00%
Math 65	10	37.00%	17	50.00%
Math 70	1	20.00%	1	33.00%
Math 91			1	100.00%
Math 93	1	100.00%	2	100.00%
Math 95	6	43.00%	7	50.00%
Math 111			0	0
Math 111B			2	33.00%
Math 111C			1	100.00%
Math 243			2	67.00%
Math 244			1	100.00%

N
Social Justice samples

⟨app:sec:socialJustic⟩ *The problems below are samples from the Social Justice Work group.*

Table N.1 shows the percentage of people living in poverty in the U.S (as defined by the government). Source: http://www.census.gov/prod/2012pubs/p60-243.pdf

TABLE N.1: Percentage of people living in poverty in the U.S

⟨app:tab:poverty⟩

Year	Percentage
1990	13.5 %
1991	14.2 %
1992	14.8 %
1993	15.1 %
1994	14.5 %
1995	13.8 %
1996	13.7 %
1997	13.3 %
1998	12.7 %
1999	11.9 %
2000	11.3 %
2001	11.7 %
2002	12.1 %
2003	12.5 %
2004	12.7 %
2005	12.6 %
2006	12.3 %
2007	12.5 %
2008	13.2 %
2009	14.3 %
2010	15.1 %
2011	15.0 %
2012	16.0 %

Make a graph of the data and try to provide evidence (articles, news stories, policy, etc) for why these rate of poverty increased or decreased. Once you completed the graph, draw in what *you* think will happen in the next 10 years, give a reason to back up what you draw in.

Math 111 Lecture Notes

Section 4.3: Exponential Functions

In 1988, a judge in Yonkers, New York instituted an *exponential* fine on the city of Yonkers. Below is the background and scenario, published in the New York Times[1]:

Dec. 1, 1980: Justice Department sues Board of Education, City of Yonkers and Yonkers Community Development Agency, charging that the city racially discriminated in education and public housing.
Nov. 20, 1985: Judge Leonard B. Sand of Federal District Court in Manhattan rules that Yonkers's housing and schools were intentionally segregated by race. A housing remedy order directs the city to build 200 units of public housing and to plan additional subsidized housing.
Jan. 28, 1988: City Council approves consent decree that sets timetable for building 200 units of public housing and commits city to an additional 800 subsidized units.
July 26, 1988: Court sets Aug. 1 deadline for Council to adopt zoning amendment needed to build the 800 units.
Aug. 1, 1988: Council rejects amendment in a 4-to-3 vote.
Aug. 2, 1988: Judge Sand finds city and the four Councilmen who voted against the amendment in contempt of court and imposes fines. The city's fines start at $100 and double every day. The Councilmen's fines start at $500 a day and increase by $500 each day.

Example 1. Let P be the amount fined (in dollars) t days after the fines were imposed. Complete the entries in Table 1 and Table 2.

TABLE 1. Councilmen

t	P	Formula
0		
1		
2		
3		
4		
5		
$\vdots$	$\vdots$	$\vdots$
t		

TABLE 2. City of Yonkers

t	P	Formula
0		
1		
2		
3		
4		
5		
$\vdots$	$\vdots$	$\vdots$
t		

[1] http://www.nytimes.com/1988/09/10/nyregion/yonkers-legal-battle-how-it-unfolded.html

Example 2. Graph each of the functions you found that model the fines for the Councilmen and the city of Yonkers. Identify the key features of each graph.

FIGURE 1. Councilmen

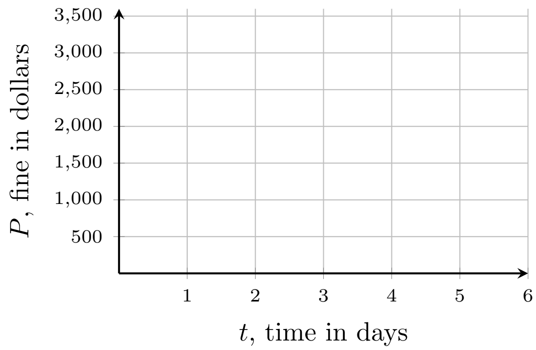

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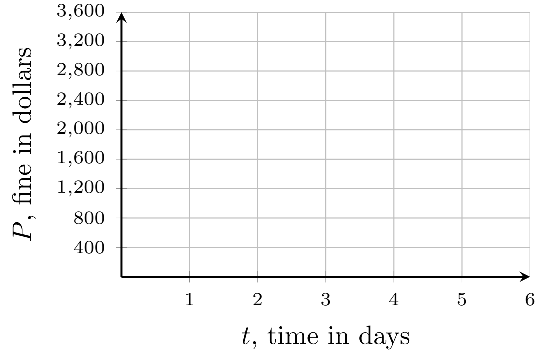
FIGURE 2. City of Yonkers



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Group Work 1. On what day will will the city of Yonkers' fine reach over $1,000,000?

Group Work 2. How much will the city of Yonkers be fined on day 30? What will each of the Councilmen's fines be on that day?

PCC Math 60 Group Project   Instructor: Jeff Pettit

Topics: Your group will choose a topic to research that relates to linear equations. You will find or measure two data points, graph that information on a graph, use the information to make a prediction, and finally create an equation based on the data. You will present your findings to the class with the graph of your data, the graph of your equation and an explanation of what the slope and y-intercept of your equation mean in context of your subject. Although our class focused on linear equations (and I encourage you to find linear data to use) if your group prefers: **you can use data sets that are not linear, or make linear approximations of data that are not linear**. I am willing and available to assist you in fitting equation(s) to data.

Submission #1, Due end of Week 5: Names of people in your group and your topic.
Submission #2, Due end of Week 6: Two data points, and what they represent.
Submission #3, Due end of Week 7: Graph of your data with appropriate scale and units.
Submission #4, Due end of Week 8: Graph of your data with appropriate scale and units and a sketch of the line between them, along with a prediction based on that line, and in interpretation of what that prediction point represents.
Submission #5, Due end of Week 9: The equation of your line from Submission #4 in slope-intercept form, with a description of what the slope and intercept represent (intercept may not have practical purpose, but it's implications should still be addressed.)

Presentation Format: Projects will consist of two parts:

1) Writing component – A brief written report beginning with a brief description of your topic and also including the following: a table of data; an accurate graph of your data; a graph of your equation; a graph of your prediction; your equation symbolically; an explanation of your equation (including slope and y-intercept). Your graph should have a correct scale and your expressions and equations should show proper notation and definition of variables. End the report with a brief interpretation of your findings and include any interesting aspects you discovered. I assume this will be approximately one page, more or less.
2) An oral or visual component (e.g. a PowerPoint presentation to the class or a poster or series of posters) explaining your topic. Your explanation should include discussion of your data, your graph and of your equation, with emphasis on the meaning of the slope and intercept.
3) Optional: Service learning component related to your topic. (e.g. planting trees, removing invasive species in Forest Park, working at the Oregon Food Bank, serving in a local soup kitchen) Depending on the type of service learning done, requirements vary, but approximately 8 hours of service learning is expected. Consult with the instructor if you believe you will have significantly less. A discussion of your service learning experience can take the place of your oral / visual component.

I. Sample project:
Student A, Student B Math 60 February 31, 2014
Gun deaths in the U.S.

Guns are a big topic in the news right now, so our group decided to examine this topic in our project, because I don't think people realize that gun violence has gone down! We found data based on the number of people killed by a gun in the U.S. per 100,000 people.

Below is a graph* from 1960 to 2008 showing the number of assault deaths per 100K people in the U.S. From this graph, I chose the ordered pairs: (2001,7) and (2005, 6).

Figure 1

X, Years after 2000	Y, Assault deaths per 100K population
1	7
5	6

Table 1

*http://www.washingtonpost.com/blogs/wonkblog/wp/2012/07/23/six-facts-about-guns-violence-and-gun-control/

As described in Table 1, in the year 2001, out of 100,000 people in the U.S., 7 people were killed. In the year 2005, four years later, there were only 6 people killed out of 100,000. This is a decline of one person per 100K over four years.

The equation for the line between these two points would be $y = -0.25x + 7.25$ where x is the years after 2000 and y is the number of assault deaths per 100,000. Here the slope of -0.25 represents the decline per year (a drop of one fourth of a person per year). The y-intercept of 7.25 represents the value for y, when x is zero (or in the year 2000). This means that based on this model, 7.25 people per 100,000 people would be killed by assault with a gun in the year 2000.

We wanted to predict if the trend would continue, so we used the model to predict the number of deaths by assault weapon in the year 2012. Our model suggests it would be:

$$\begin{aligned} y &= -0.25(12) + 7.25 \\ &= -3 + 7.25 \\ &= 4.25 \end{aligned}$$

This suggests that there would be only 4.25 people per 100000 people killed in 2012 using our model. We tried to compare that number with the actual number, but we couldn't find that information.

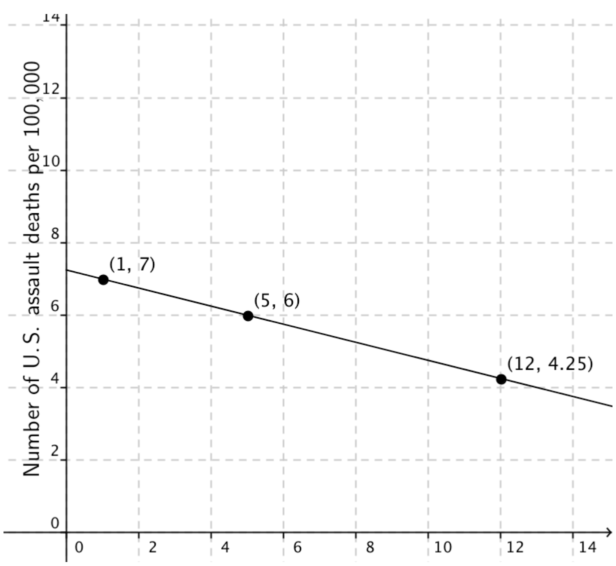


Figure 2

In conclusion, we believe the incidents of deadly assault by gun will continue to go down until we are relatively equal with other countries. Also, in doing this research, we found that Mexico had the highest incident and has been higher than the U.S. for several years.

O
Class size report

?⟨app:sec:classsize⟩? *The following report was submitted to the DOIs.*

MATHEMATICS SAC CLASS SIZE RECOMMENDATION

A report prepared for the Math SAC and DOI's

Portland Community College

CONTENTS

BACKGROUND INFORMATION

According to the PCC Faculty Federation,

ARTICLE 26 – PARTICIPATION & COLLEGE SERVICE

26.24 Class Size. The SAC will periodically review class size limits with regard to both instructional soundness and fiscal responsibility. Recommendations for changes will be stated in writing. The SAC and Administrative Supervisor(s) will then reach written consensus (see Article 1.06) regarding any revised limits. Any revisions will be established prior to schedule input deadlines.

At a Math SAC meeting on February 10th, information about class sizes at other colleges and class sizes at PCC was shared. Table 1 below shows class cap size data that was collected from department chairs across the state.

Table 1

Community College	Math 20	Math 60/65	Math 95	Math 111 or higher
Clackamas	30	35	35	35
Clark	30	30	30	35
Mt. Hood	34	34	34	34
Chemeketa	35	35	35	35
Linn-Benton	45 (see note)	35	35	35
Lane	31	31	36	36
Central Oregon	25	35	35	35
Blue Mountain	25	25	25	25
Rogue	30	30	30	30
Treasure Valley	24-30	24-30	24-30	24-30
Portland Community College	35	38	36	38

Note: Linn-Benton's MTH 20 classes have a cap of 45. For each MTH 20 class, there is one instructor, one assistant instructor, and three instructional aides.

Exceptions: A couple of colleges reported smaller caps for the 211-213 sequence (LBCC - 24, LCC - 31). LBCC also has a cap of 30 for statistics courses. LCC has a cap of 28 for their discrete math course.

Table 3 shows the average class size for PCC Math Classes at each campus from Fall 2011 along with the Week 4 Actual Class Size. The concern among faculty was not over the average Cap size, it was over the trend of increasing class sizes. In particular, some class caps were set as high as 38 students. The concern is that larger class sizes are adversely affecting the learning environment of the students. Larger class sizes make it harder to have effective group work sessions and activities in the classroom. Larger classes also make it harder for the teacher to effectively work individually with students. The different class caps at different campuses create an inequity among student learning experiences. As a SAC that values consistency in our program, we feel that as much as possible, class sizes should be consistent (at least in maximum size) so that students can get a consistent educational experience.

Table 3

Campus	**Cap size (Average)**	**Week 4 Actual**
Sylvania	33.7	30.8
Cascade	32.1	31.4
Rock Creek	30.2	26.8
ELC	28.2	27.4
District Wide	31.5	29.1

Table 2

Class	Cap Size	Maximum Week 4 Enrollment[1]
Math 20	35	37
Math 60/65	38	44
Math 61,62,63,91, 92	35	37
Math 70	38	38
Math 93	38	18
Math 95	36	42
Math 111/112	38	46
Math 243/244	35	35
Math 251	35	34
Math 252-254, 256, 261	38	38

[1] Highest enrollment among all sections, campus wide.

As a result of the February 10th , 2012 meeting, the SAC suggested to the DOI's lowering class caps to no more than 35 students while a committee worked to find reasonable class sizes.

> *"The SAC recommends face to face class sizes be changed to no more than 35 starting summer 2012. A committee will be formed to investigate appropriate class sizes. The committee will make their recommendations prior to the deadline for the fall 2012 schedule."*

On April 16th, 2012 we received the following administrative response:

> *Rather than make a decision for summer that may not continue after consideration of the overall review, we'll wait for the MTH SAC's complete report on this subject. Since Summer registration doesn't begin until 15 May, we have time to adjust summer enrollment limits before students begin to register. In conducting the overall review, we would appreciate consideration of how enrollment limits might be reduced, maintained, or increased to provide as close to an enrollment-neutral position as possible. For example, enrollment limits in MTH 20 might be reduced and limits in DL offerings might be increased.*

COMMITTEE RECCOMENDATIONS

A committee was formed to investigate appropriate class sizes and met on March 3rd 2012. A survey of faculty was sent out and 60 faculty members (32 part-time and 28 full-time) responded. Most faculty members were supportive of smaller class sizes in regards to how smaller class sizes would better serve students. The results from this survey can be found in the appendix.

The Mathematics SAC believes that creating class caps that are below our current maximum of 38 students per class will improve the learning environment and college experience for our students. Here are some of the reasons we (the Math SAC) recommend this:

- We believe that group work is an important part of the mathematics classroom. This is related to PCC's core outcome of **Community and Environmental Responsibility and Communication.** Large class sizes do not lend themselves to group work very well because the instructor is unable to give each group enough attention. For example, if you have 8 groups of 4, you can spend 3.75 minutes per group in a 30 minute session. If you have 10 groups of 4, you can only spend 3 minutes per group in a 30 minute session.
- We believe that feedback and assessment is an important part of the learning process. The quality and frequency of feedback can be reduced as class sizes get larger and instructors try to manage their workload. Instructors may choose to give fewer assessments and assignments in a larger class because of the increased workload.
- Quality feedback on things like format and notation cannot be automated. We believe that quality feedback can be useful to improving student work. This is related to PCC's core outcome of **Communication.**

- Timely feedback—if a student is to learn from and correct their mistakes, they need to get their work back in a timely manner. Increasing class sizes could decrease the likelihood that students will receive their work back promptly.

- We believe that questions are an important part of the learning process. In larger classes, students tend to feel they are unable to get all of their questions answered. This was a trend that we noticed in our student survey. Further results will be discussed in our program review.

- Students expect consistency among their classes. Class sizes fluctuate from campus to campus and from class to class at the same campus. We know that not a lot can be done about small class sizes or small classrooms, but we can do something about large class sizes.

- Students have noticed the increase in class sizes (see Responses from Student Survey)

- Students expect lower class sizes at a community college than at a university. While our class sizes/caps are lower in some cases, they are higher in many others. In particular, we have higher class caps in Math 70 and Math 105. Our class caps are very similar to PSU's for Math 111, 112, and 252-256. See Table 4 in the appendix.

- Both the MAA and AMATYC recommend class sizes of no more than 30 students (see Reccomendations from National Mathematics Associations later in this document).

The Math SAC also believes that creating class caps are important for the faculty. High class sizes diminish our ability to serve students and the college effectively. Here is why we think class caps are important for faculty.

- Work load equity. Class sizes for the same class range from 24 students to 38 students. For a full time faculty member, it would be possible to have anywhere from 100-152 students per term. We know that variation is expected. For faculty who are on the higher side of student contact hours, we find it harder to manage group work in class, difficult to complete our student work (such as grading) outside of the class, and manage our many committee responsibilities.

After discussing the results of the Math SAC survey and having follow-up conversations with faculty, the class size subcommittee came up with the following recommendations. In most cases, the class size was set at 32, but in some cases it was set lower (reasons given below).

- Math 20 is a fast paced course with a lot of curriculum. Although it is intended as a review course, many students enter without the necessary pre-requisite skills or have gaps in their knowledge. There needs to be adequate time for student questions. In addition, smaller class sizes allow for more group work and more individual attention.
- Math 61-63 is a slower version of the Math 60/65 sequence. Anxiety and behavioral issues are frequent in this class. A smaller class size allows for the instructor to deal with these issues more effectively.
- Math 93 is the calculator instruction class. Questions are frequent and nearly always require individual attention with the instructor physically going to the student and looking at their calculator entry.
- Math 211-213 employs frequent group work. Class sizes were chosen so that there are no more than 7 groups of 4.
- Math 251 has a lab component where students are working in groups for 3 hours per week. Although a lab assistant is usually hired for classes with more than 25 students, it can still be hard to get to all groups with a lab assistant. The lab assistant should remain a part of the course. There is also a very high grading load with the lab component of this course. The labs are critical to developing student's mathematical communication and timely feedback is crucial to this development.
- Both the MAA and AAMATYC recommend class sizes of no more than 30 students.

Math Class	Recommended Class Size
30	32
20	28
60/65/70	32
61-63	24
91/92	24
93	24
95	32
105	32
111/112	32
211-213	28
243-244	32
251	28
252-256 **261**	32

SUPPORTING RESEARCH/DOCUMENTATION

RESEARCH ON CLASS SIZES/PEDAGOGY

Class size research is limited and often contradictory. Class size is only one factor in a myriad of factors that affect student success. Smaller class sizes do offer more opportunities for instructors to use innovative teaching techniques, for students to participate in meaningful group work and for students to know their peers and interact with their instructor.

Effects of a Syllabus Offer of Help, Student Age, and Class Size on College Students' Willingness to Seek Support from Faculty, Perrine and Lisle, Journal of Experimental Education, Fall95, Vol. 64 Issue 1, p41

> *As class size increases, students perceive teachers to be less concerned about students and less respectful of them. Students also perceive teachers of large classes to be less available and less helpful. If students perceive teachers of large classes to be less concerned about them and less available, they would be more hesitant to seek help from an instructor in a large class than in a smaller class.*

Overview of Class Size Research, Judy Shoemaker, DUE/Research and Evaluation, November 1, 2007

> *Research has shown that the following types of students benefit most from small classes: most able, those with low motivation, those with high affiliation needs, beginners in the subject matter, students from low economic backgrounds, and those predisposed to learn facts rather than apply or synthesize.*

Cohorts and Relatedness: Self-Determination Theory as an Explanation of How Learning Communities Affect Educational Outcomes, Beachboard, M., Beachboard, J., Li, W., & Adkison, S. (2011). Research In Higher Education, 52(8), 853-874. doi:10.1007/s11162-011-9221-8

> *Measuring **student** perceptions of the contributions of their institutions, the study found increased **relatedness** to peers and faculty and increased higher order thinking assignments (a control variable included in the research model) to be substantial predictors of educational outcomes relevant to literacy, critical thinking, and, especially, job preparation. The researchers suggest that institutions will want to ensure that their learning community designs enhance **student** feelings of **relatedness**.*

Classroom Organization and Participation: College Students' Perceptions, Robert R. Weaver; Jiang Qi, The Journal of Higher Education, Vol. 76, No. 5 (Sep. - Oct., 2005), pp. 570-601

> *Students who actively participate in the learning process learn more than those who do not. "Involvement matters," as Tinto (1997) points out, and this involvement can occur both inside and outside the classroom, … Active involvement in class facilitates critical thinking (Garside, 1996) and facilitates the retention of information that might otherwise be lost (Bransford, 1979). If student participation is so central to the learning process, why is participation in the college classroom frequently so low? What constrains the more active involvement of students? Scholars have identified a host of factors ranging from, for instance, class size, faculty authority, gender, age, student preparation, or student emotions such as confidence or fear.*

RECCOMENDATIONS FROM NATIONAL MATHEMATICS ASSOCIATIONS

The American Mathematical Association of Two-Year Colleges Guidelines for Mathematics Departments at two year colleges:

> *Mathematics departments should be adequately staffed to allow for a maximum class size of thirty students. Opportunity for frequent interaction between students and instructors should be provided, both in the classroom and in office consultations.*

The Mathematical Association of Americas Guidelines for Programs and Departments in Undergraduate Mathematical Sciences:

> *Departments must be provided with the resources necessary to deliver high quality teaching that includes the opportunity for students to interact frequently and nontrivially with their instructors. Departments should facilitate these personal interactions by avoiding the use of large lecture settings that require students to become passive audiences. The best way to encourage active student-faculty interactions and to enable faculty to give students individual attention is to provide a small-class environment with fewer than thirty students in each section. Also with restricted class size, faculty members gain flexibility to adopt a teaching style that best fits both the material to be learned and their students' needs.*

RESPONSES FROM FACULTY SURVEY

- Smaller class sizes allow us to devote more energy and attention to each student. This is especially important in the developmental math classes.
- I teach 20 a lot and it's demanding both for students and teacher, as well as involving many students with poor study skills and problematic attitudes, so... smaller is better. That way also we have more time to give detailed feedback on homework.
- I taught a Math 65 this term with 39 students. One of the best groups I have ever had, but even so, there were simply too many students for me to be able to adequately answer questions and work with individuals in class.
- Math 95 has both challenging material for students (less review than previous classes) and moves at quicker pace. For this reason a smaller class size would allow for more "at the board" activities or group interaction. Also this class requires instruction for CAS so this would be ideal on a smaller class size.

RESPONSES FROM STUDENT SURVEY

As part of PCC's assessment of core outcomes, the math department conducted a survey of students to measure self-reflection and professional competence. Here are some un-edited responses from students in reference to class sizes.

Think of a time in a math class where you have NOT experienced success. What prevented you from succeeding?

- I could not understand the concepts and it was hard to get help since it was a large class.

- Time to work on in-class activities is frustrating in a large class when it is a new topic and only once instructor to walk around and help. I find myself sitting for up to fifteen minutes at a time doing absolutely nothing, waiting for an instructor to help. It would be awesome if a teacher's aid were present during this time for additional help.
- large class sizes and teachers who taught straight out of a book.
- Too large of class size. A student becomes lost in a sea of people. The larger the class size, the more intimidated a person is to ask a question when they don't understand something. Hear that PCC? Stop trying to squeeze every last penny out of a classroom!

Think of a time in a math class where you have experienced success. What lead to that success?

- an engaging teacher and smaller class sizes.
- I learn better in small groups where there is not much noise.
- I think a clear understand of what the teacher is saying and working in groups helped me to understand the subject.

INSTITUTIONAL RESEARCH

It is very difficult to isolate class size as a factor in student success. There are many other factors to consider such as instructors, campus, time of day, previous college history, etc.

Using data from Fall 2011, we found the following information (see appendix for regression analysis) with regards to class size and success rates:

- There is a significant negative relationship between class size and success rates for Math 20 at Sylvania (where class sizes for Math 20 are higher than at other campuses). See

Table 4: PCC vs PSU Cap size and enrollment		
Class	PCC Cap /Actual Enrollment	PSU Cap /Actual Enrollment
70	38/34.5	30/29.5
95	36/30.1	40/33.3
105	38/28.33	35/29.5
111	38/30.3	40/37.7

112	38/30.1	40/38.75
211-213	38/18.75	35/20.6
251	35/27.9	40/35
252-256	38/25.3	40/37
261	34/24.5	50/46

- Table 5 for results. Sylvania does have significantly higher success rates for Math 20, so including their data with all campuses distorts any relationship between class size and success rates.
- There is a significant negative relationship between class size and success rates for Math 61-63 and 93 (we recommend smaller class sizes for these classes).
- There is a non-significant negative relationship between class size and success rates for Math 251.
- There is a negative relationship between class size and success rates for Math 211-213 but the sample size is too small for regression results to be valid.

FINANCIAL IMPLICATIONS

The financial implications of reduced class sizes were not thoroughly investigated by the committee or the SAC. We feel that increasing class sizes in not an appropriate response to increases in enrollment. Reducing class sizes *will* result in the need to increase the number of sections offered. Our calculations are based on dividing enrollment by the suggested cap size. Under this assumption, the fill rates for each campus will remain virtually unchanged. We do realize that there are limitations on room size and space that cannot be avoided and that this may change the number of sections needed.

We do agree that it is reasonable to ask instructors to take 1-2 students above their cap so as not to necessitate the need for an additional section. We do not agree with the administrative response to take up the excess students in our online classes. Distance education is not the best option for the vast majority of students and many of our DL classes are already at capacity. Offering more DL sections would in many cases mean taking an experienced instructor out of a classroom. **We are not recommending changing the distance learning cap sizes.**

WITHIN CAMPUS ENROLLMENT NEUTRAL

In order to remain enrollment neutral within campuses (based on actual enrollment from Fall 2011 provided by IE), the following sections would need to be added for a typical **fall term.** (Note: some of these recommendations are not based solely on a reduction of class size, but rather on a trend of high enrollment in these classes. In other words, some additional sections may have been needed regardless of a change in class size).

- Math 20: 3 sections at SY, 1 section at CA
- Math 60: 1 section at SY, 1 at CA
- Math 61/62/63: 1 section of each at either CA, SE or SY. There aren't enough students to justify a whole extra section at any one campus.
- Math 65: No additional sections needed.
- Math 70: 1 additional section needed district wide (either CA or SY)
- Math 95: 1 section at SY, 1 at CA

- Math 111: 0 at SY, 1 at CA
- Math 112: 0 at SY, 0 at CA
- Math 253: 1 section needed district wide

CONCLUSION

The mathematics SAC recommends lowering the class caps for our classes to create consistency between classes and campuses, increase the likelihood of teacher/student interaction and to create workload equity. Lower class sizes will serve our math students better because it will increase the quality of the instructional environment and learning experience. We believe our recommendations to be fair, thoughtful and justified. We look forward to your response.

APPENDIX (FIGURES, CHARTS AND DATA)

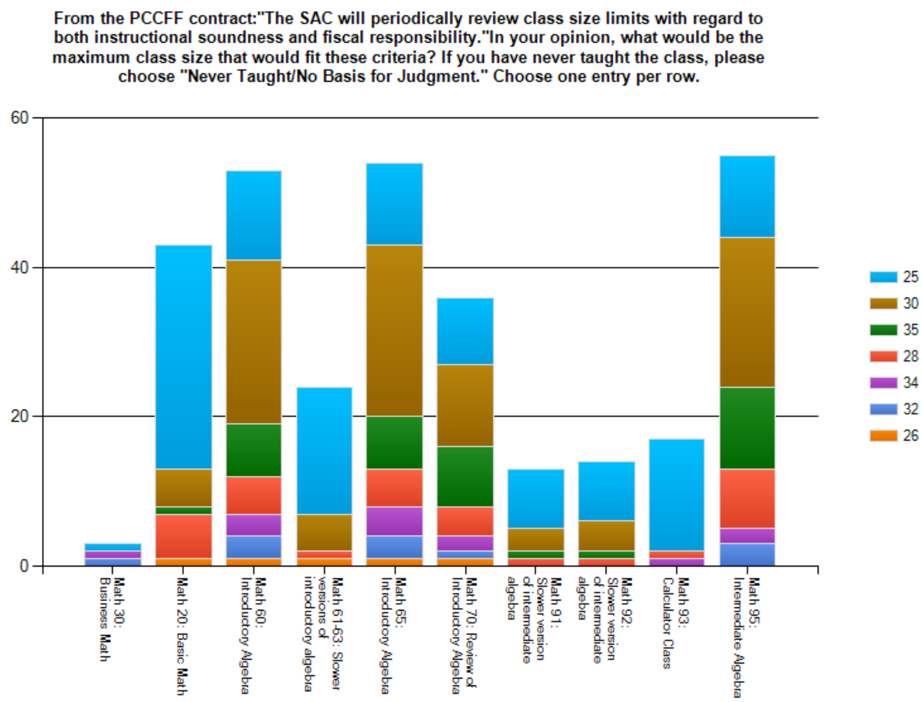


Figure 1: Faculty Class Size Responses for Pre-College Classes

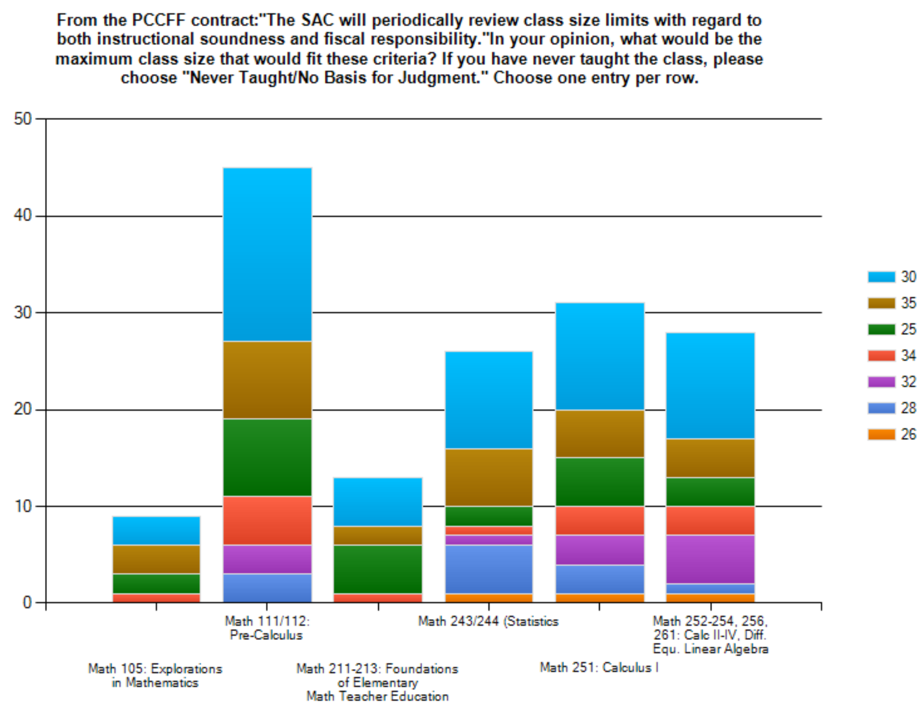


Figure 2: Faculty Class Size Responses for College Level (100+) Classes

Table 4: PCC vs PSU Cap size and enrollment		
Class	PCC Cap[2] /Actual Enrollment[3]	PSU Cap /Actual Enrollment
70	38/34.5	30/29.5
95	36/30.1	40/33.3
105	38/28.33	35/29.5
111	38/30.3	40/37.7
112	38/30.1	40/38.75
211-213	38/18.75	35/20.6
251	35/27.9	40/35
252-256	38/25.3	40/37
261	34/24.5	50[4]/46

[2] The maximum cap across all sections/campuses. Obtained from MyPCC and MyPDX

[3] The average class size across all sections/campuses (at the end of Week 4). Obtained from PCC IE and MyPDX

[4] Math 261 is a markedly different course at PSU with less content and lower pre-requisites.

Table 5: Regression Analysis for Math 20 at SY

Simple linear regression results:

Dependent Variable: Pass Rate

Independent Variable: Math20ClassSize@SY

Pass Rate = 136.29749 - 1.9686614 Math20ClassSize@SY

Sample size: 19

R (correlation coefficient) = -0.5495

R-sq = 0.30199733

Estimate of error standard deviation: 10.279198

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-Value
Intercept	136.29749	23.462055	≠ 0	17	5.809273	<0.0001
Slope	-1.9686614	0.7258946	≠ 0	17	-2.7120488	0.0148

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	777.16534	777.16534	7.355208	0.0148
Error	17	1796.2526	105.66191		
Total	18	2573.418			

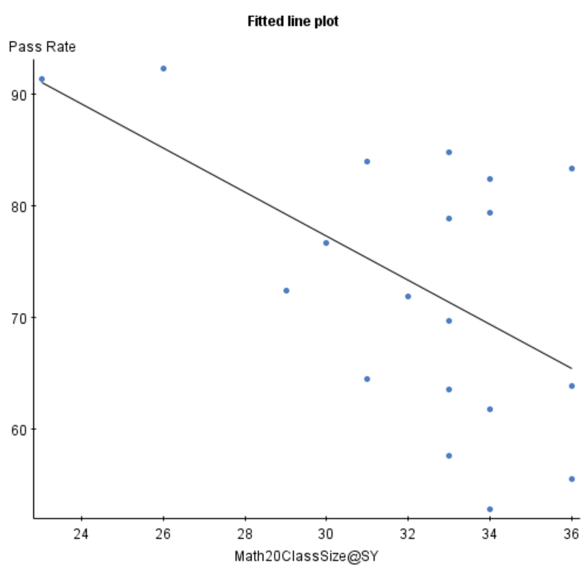


Table 6: Regression Analysis for Math 61-63, 93

Simple linear regression results:

Dependent Variable: Pass Rate
Independent Variable: Math61-63,93 Class Size
Pass Rate = 95.61773 - 1.2053437 Math61-63,93 Class Size
Sample size: 14
R (correlation coefficient) = -0.5199
R-sq = 0.27031055
Estimate of error standard deviation: 14.08319

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-Value
Intercept	95.61773	16.841545	≠ 0	12	5.6774917	0.0001
Slope	-1.2053437	0.5716863	≠ 0	12	-2.1084003	0.0567

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	881.6745	881.6745	4.4453526	0.0567
Error	12	2380.035	198.33623		
Total	13	3261.7092			

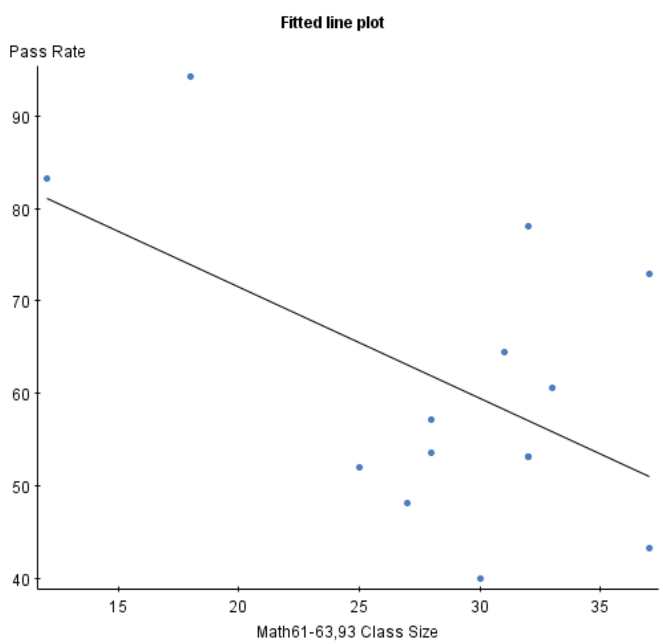


Table 7: Regression Analysis for Math 251

Simple linear regression results:
Dependent Variable: Success Rate
Independent Variable: Math 251 Class Size
Success Rate = 106.12736 - 1.2180774 Math 251 Class Size
Sample size: 12
R (correlation coefficient) = -0.4172
R-sq = 0.17406653
Estimate of error standard deviation: 11.075829

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-Value
Intercept	106.12736	23.91794	≠ 0	10	4.4371443	0.0013
Slope	-1.2180774	0.8390538	≠ 0	10	-1.4517275	0.1772

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	258.53696	258.53696	2.1075127	0.1772
Error	10	1226.7397	122.67397		
Total	11	1485.2766			

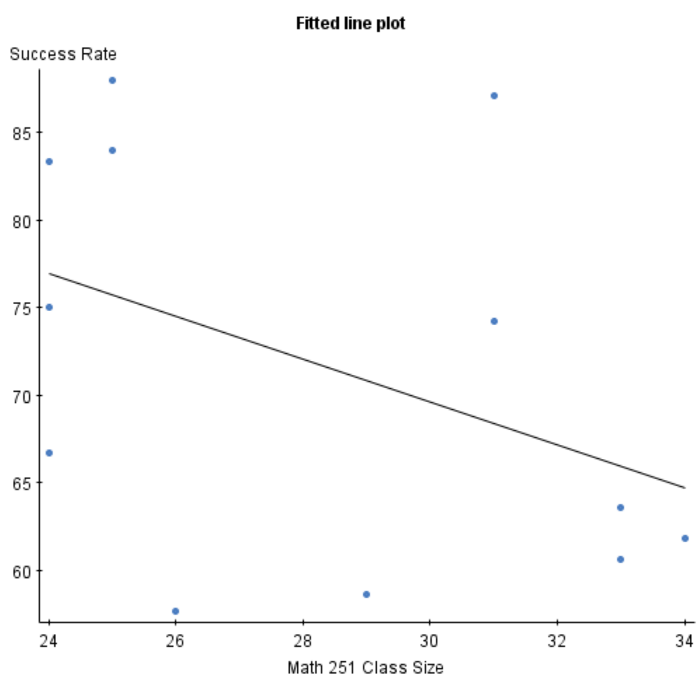


Table 8: Regression Analysis for Math 211-213

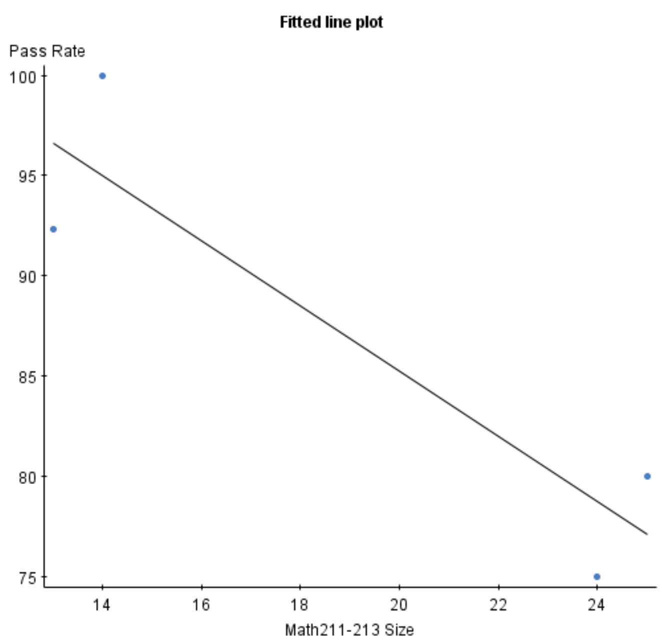
Simple linear regression results:
Dependent Variable: Pass Rate
Independent Variable: Math211-213 Size
Pass Rate = 117.78565 - 1.6295081 Math211-213 Size
Sample size: 4
R (correlation coefficient) = -0.9114
R-sq = 0.8307006
Estimate of error standard deviation: 5.745488

Parameter estimates:

Parameter	Estimate	Std. Err.	Alternative	DF	T-Stat	P-Value
Intercept	117.78565	10.292311	≠ 0	2	11.444043	0.0075
Slope	-1.6295081	0.52017206	≠ 0	2	-3.132633	0.0886

Analysis of variance table for regression model:

Source	DF	SS	MS	F-stat	P-value
Model	1	323.94623	323.94623	9.81339	0.0886
Error	2	66.02127	33.010635		
Total	3	389.9675			



P
Demographic data

⟨app:sec:demographicdata⟩ Tables P.1 to P.10 show demographic data for the academic years 2008 through 2013.

08–2009)?

TABLE P.1: Demographic data for 2008–2009 (Pre-college level MTH and statistics)

2008–2009	MTH 20 Total	MTH 20 % Total	MTH 20 % Pass	MTH 60 Total	MTH 60 % Total	MTH 60 % Pass	MTH 65 Total	MTH 65 % Total	MTH 65 % Pass	MTH 95 Total	MTH 95 % Total	MTH 95 % Pass	MTH 243 Total	MTH 243 % Total	MTH 243 % Pass	MTH 244 Total	MTH 244 % Total	MTH 244 % Pass
Headcount	3,650		70 %	6,039		69 %	4,006		74 %	3,540		72 %	1,780			692		
Female	2,209	61 %	75 %	3,266	55 %	72 %	2,282	58 %	75 %	1,965	56 %	73 %	1,021	58 %	80 %	354	52 %	87 %
Male	1,409	39 %	64 %	2,711	45 %	65 %	1,679	42 %	72 %	1,529	44 %	70 %	735	42 %	80 %	327	48 %	83 %
	3,618			5,977			3,961			3,494			1,756			681		
White	2,067	64 %	74 %	3,857	75 %	70 %	2,611	76 %	73 %	2,261	75 %	73 %	1,091	71 %	81 %	381	65 %	86 %
Asian	180	6 %	77 %	312	6 %	69 %	225	7 %	75 %	290	10 %	74 %	202	13 %	77 %	90	15 %	89 %
Hispanic	358	11 %	70 %	445	9 %	68 %	308	9 %	78 %	236	8 %	63 %	91	6 %	73 %	36	6 %	86 %
Black	459	14 %	55 %	343	7 %	50 %	158	5 %	61 %	127	4 %	60 %	56	4 %	66 %	24	4 %	63 %
Native American	78	2 %	59 %	112	2 %	64 %	69	2 %	67 %	47	2 %	74 %	16	1 %	56 %	9	2 %	78 %
Pacific Islander	2	0 %	50 %	2	0 %	0 %	0	0 %	0 %	0	0 %	0 %	1	0 %	0 %	0	0 %	0 %
Multiracial	39	1 %	59 %	54	1 %	41 %	27	1 %	67 %	19	1 %	74 %	9	1 %	100 %	3	1 %	33 %
Foreign/International	24	1 %	79 %	37	1 %	81 %	35	1 %	89 %	36	1 %	86 %	69	4 %	91 %	45	8 %	91 %
	3,207			5,162			3,433			3,016			1,535			588		
Age: 19 & less	1,380	38 %	65 %	2,223	37 %	65 %	1,333	33 %	68 %	1,138	32 %	64 %	370	75 %	75 %	134	19 %	80 %
20-24	812	22 %	68 %	1,440	24 %	68 %	1,057	26 %	69 %	1,000	28 %	69 %	617	76 %	76 %	265	38 %	82 %
25-29	532	15 %	79 %	985	16 %	73 %	700	17 %	81 %	657	19 %	80 %	385	85 %	85 %	147	21 %	88 %
30-39	558	15 %	76 %	877	15 %	74 %	593	15 %	81 %	529	15 %	79 %	300	86 %	86 %	103	15 %	92 %
40-49	244	7 %	77 %	375	6 %	71 %	239	6 %	82 %	170	5 %	81 %	86	83 %	83 %	32	5 %	94 %
50+	124	3 %	71 %	138	2 %	70 %	84	2 %	77 %	46	1 %	83 %	22	82 %	82 %	11	2 %	82 %

TABLE P.2: Demographic data for 2008–2009 (College level MTH)

2008–2009	MTH 111A Total	MTH 111A % Total	MTH 111A % Pass	MTH 111 B&C Total	MTH 111 B&C % Total	MTH 111 B&C % Pass	MTH 112 Total	MTH 112 % Total	MTH 112 % Pass	MTH 251 Total	MTH 251 % Total	MTH 251 % Pass	MTH 252 Total	MTH 252 % Total	MTH 252 % Pass	MTH 253 Total	MTH 253 % Total	MTH 253 % Pass	MTH 254 Total	MTH 254 % Total	MTH 254 % Pass
Headcount	14			2,849			984		71 %	641		75 %	470		77 %	301		80 %	186		84 %
Female	8	62 %	63 %	1,464	52 %	77 %	321	33 %	73 %	193	30 %	80 %	128	28 %	81 %	61	21 %	82 %	36	20 %	94 %
Male	5	38 %	80 %	1,353	48 %	73 %	654	67 %	71 %	441	70 %	74 %	336	72 %	75 %	235	79 %	80 %	148	80 %	81 %
	13			2,817			975			634			464			296			184		
			67 %																		
White	6	67 %	100 %	1,786	74 %	75 %	613	74 %	72 %	387	72 %	76 %	279	71 %	82 %	186	72 %	80 %	116	73 %	87 %
Asian	2	22 %	100 %	270	11 %	81 %	104	13 %	70 %	70	13 %	83 %	53	14 %	79 %	35	14 %	94 %	22	14 %	86 %
Hispanic	1	11 %	0 %	154	6 %	70 %	43	5 %	65 %	25	5 %	64 %	21	5 %	71 %	11	4 %	91 %	9	6 %	78 %
Black	0	0 %	0 %	80	3 %	58 %	27	3 %	78 %	26	5 %	54 %	15	4 %	40 %	4	2 %	100 %	4	3 %	75 %
Native American	0	0 %	0 %	50	2 %	66 %	12	1 %	67 %	5	1 %	60 %	6	2 %	83 %	2	1 %	100 %	0	0 %	0 %
Pacific Islander	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %
Multiracial	0	0 %	0 %	24	1 %	63 %	9	1 %	56 %	4	1 %	50 %	1	0 %	100 %	0	0 %	0 %	0	0 %	0 %
Foreign/International	0	0 %		62	3 %	87 %	19	2 %	84 %	21	4 %	90 %	17	4 %	100 %	19	7 %	74 %	8	5 %	88 %
	9			2,426			827			538			392			257			159		
			50 %																		
Age: 19 & less	4	29 %	83 %	894	31 %	69 %	307	31 %	64 %	169	26 %	70 %	124	26 %	73 %	84	28 %	88 %	42	23 %	88 %
20-24	6	43 %	0 %	907	32 %	75 %	311	32 %	68 %	194	30 %	76 %	141	30 %	78 %	89	30 %	72 %	58	31 %	84 %
25-29	0	0 %	67 %	518	18 %	82 %	179	18 %	77 %	134	21 %	79 %	105	22 %	82 %	66	22 %	83 %	47	25 %	81 %
30-39	3	21 %	0 %	376	13 %	79 %	142	14 %	84 %	117	18 %	76 %	79	17 %	81 %	49	16 %	82 %	30	16 %	80 %
40-49	0	0 %	100 %	121	4 %	79 %	36	4 %	78 %	21	3 %	90 %	19	4 %	68 %	12	4 %	67 %	8	4 %	88 %
50+	1	7 %	7 %	33	1 %	88 %	9	1 %	89 %	5	1 %	40 %	2	0 %	0 %	1	0 %	100 %	1	1 %	100 %

TABLE P.3: Demographic data for 2009–2010 (Pre-college level MTH and statistics)

2009–2010	MTH 20 Total	MTH 20 % Total	MTH 20 % Pass	MTH 60 Total	MTH 60 % Total	MTH 60 % Pass	MTH 65 Total	MTH 65 % Total	MTH 65 % Pass	MTH 95 Total	MTH 95 % Total	MTH 95 % Pass	MTH 243 Total	MTH 243 % Total	MTH 243 % Pass	MTH 244 Total	MTH 244 % Total	MTH 244 % Pass
Headcount	4,673		68 %	7,714		67 %	5,190		72 %	4,352		72 %	2,219		80 %	859		83 %
Female	2,744	59 %	71 %	3,931	51 %	69 %	2,814	55 %	73 %	2,361	55 %	74 %	1,272	58 %	83 %	441	52 %	85 %
Male	1,876	41 %	63 %	3,706	49 %	65 %	2,327	45 %	71 %	1,948	45 %	70 %	926	42 %	76 %	404	48 %	83 %
	4,620			7,637			5,141			4,309			2,198			845		
White	2,660	63 %	71 %	4,951	73 %	68 %	3,363	75 %	73 %	2,787	75 %	73 %	1,359	73 %	80 %	504	69 %	85 %
Asian	188	4 %	74 %	352	5 %	74 %	257	6 %	72 %	262	7 %	76 %	244	13 %	85 %	101	14 %	87 %
Hispanic	422	10 %	71 %	566	8 %	66 %	372	8 %	68 %	308	8 %	66 %	90	5 %	70 %	43	6 %	84 %
Black	636	15 %	52 %	502	7 %	45 %	260	6 %	61 %	182	5 %	66 %	54	3 %	74 %	27	4 %	70 %
Native American	98	2 %	65 %	121	2 %	64 %	89	2 %	66 %	68	2 %	63 %	26	1 %	69 %	13	2 %	85 %
Pacific Islander	16	0 %	69 %	33	0 %	61 %	15	0 %	53 %	5	0 %	40 %	4	0 %	75 %	0	0 %	0 %
Multiracial	148	4 %	55 %	197	3 %	59 %	91	2 %	65 %	55	1 %	65 %	21	1 %	81 %	7	1 %	71 %
Foreign/International	23	1 %	87 %	47	1 %	85 %	38	1 %	87 %	44	1 %	84 %	68	4 %	81 %	35	5 %	89 %
	4,191			6,769			4,485			3,711			1,866			730		
Age: 19 & less	1,519	33 %	63 %	2,414	31 %	64 %	1,537	30 %	63 %	1,246	29 %	65 %	424	19 %	73 %	133	15 %	77 %
20-24	979	21 %	69 %	1,820	24 %	68 %	1,328	26 %	71 %	1,178	27 %	68 %	706	32 %	77 %	336	39 %	84 %
25-29	763	16 %	72 %	1,443	19 %	70 %	1,001	19 %	78 %	831	19 %	79 %	525	24 %	84 %	198	23 %	86 %
30-39	805	17 %	71 %	1,330	17 %	69 %	919	18 %	80 %	784	18 %	79 %	416	19 %	87 %	135	16 %	85 %
40-49	430	9 %	72 %	500	6 %	67 %	298	6 %	82 %	237	5 %	80 %	120	5 %	84 %	44	5 %	84 %
50+	177	4 %	69 %	207	3 %	65 %	107	2 %	78 %	76	2 %	74 %	28	1 %	75 %	13	2 %	77 %

TABLE P.4: Demographic data for 2009–2010 (College level MTH). Note that MTH 111A had 0 enrollment for 2009–2010, so its data is not displayed.

2009–2010	MTH 111 B&C Total	MTH 111 B&C % Total	MTH 111 B&C % Pass	MTH 112 Total	MTH 112 % Total	MTH 112 % Pass	MTH 251 Total	MTH 251 % Total	MTH 251 % Pass	MTH 252 Total	MTH 252 % Total	MTH 252 % Pass	MTH 253 Total	MTH 253 % Total	MTH 253 % Pass	MTH 254 Total	MTH 254 % Total	MTH 254 % Pass
Headcount	3,507			1,236		68 %	780		73 %	520		79 %	359		81 %	217		86 %
Female	1,767	51 %	75 %	406	33 %	68 %	210	27 %	72 %	137	26 %	83 %	85	24 %	86 %	47	22 %	91 %
Male	1,704	49 %	78 %	819	67 %	68 %	565	73 %	73 %	380	74 %	78 %	273	76 %	79 %	169	78 %	84 %
	3,471			1,225			775			517			358			216		
White	2,225	75 %	78 %	784	75 %	65 %	481	72 %	72 %	315	75 %	82 %	237	80 %	80 %	139	76 %	85 %
Asian	263	9 %	76 %	128	12 %	74 %	88	13 %	67 %	58	14 %	84 %	32	11 %	84 %	21	12 %	90 %
Hispanic	196	7 %	73 %	55	5 %	78 %	31	5 %	74 %	14	3 %	71 %	10	3 %	70 %	7	4 %	100 %
Black	111	4 %	65 %	24	2 %	79 %	17	3 %	71 %	12	3 %	67 %	5	2 %	100 %	5	3 %	60 %
Native American	49	2 %	71 %	12	1 %	33 %	7	1 %	71 %	2	0 %	50 %	1	0 %	0 %	2	1 %	100 %
Pacific Islander	5	0 %	60 %	1	0 %	0 %	1	0 %	0 %	0	0 %	0 %	0	0 %	0 %	0	0 %	0 %
Multiracial	45	2 %	80 %	15	1 %	60 %	8	1 %	63 %	2	0 %	100 %	2	1 %	100 %	1	1 %	100 %
Foreign/International	54	2 %	96 %	31	3 %	84 %	31	5 %	81 %	19	5 %	95 %	11	4 %	91 %	7	4 %	100 %
	2,948			1,050			664			422			298			182		
Age: 19 & less	988	28 %	75 %	383	31 %	60 %	208	27 %	71 %	118	23 %	74 %	73	20 %	78 %	36	16 %	86 %
20-24	1,070	31 %	75 %	376	30 %	67 %	245	31 %	71 %	176	34 %	78 %	114	32 %	78 %	63	29 %	81 %
25-29	680	19 %	79 %	229	19 %	76 %	171	22 %	77 %	115	22 %	92 %	84	23 %	86 %	56	26 %	93 %
30-39	575	16 %	81 %	168	14 %	73 %	120	15 %	73 %	83	16 %	76 %	66	18 %	80 %	49	22 %	86 %
40-49	143	4 %	80 %	59	5 %	71 %	28	4 %	64 %	22	4 %	68 %	18	5 %	89 %	14	6 %	86 %
50+	51	1 %	71 %	21	2 %	86 %	8	1 %	88 %	7	1 %	86 %	4	1 %	100 %	1	0 %	0 %

TABLE P.5: Demographic data for 2010–2011 (Pre-college level MTH and statistics)

2010–2011	MTH 20			MTH 60			MTH 65			MTH 95			MTH 243			MTH 244		
	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass
Headcount	4,590		66 %	7,937		66 %	5,519		72 %	4,814		71 %	2,330		79 %	904		82 %
Female	2,604	57 %	70 %	4,137	53 %	69 %	2,971	54 %	74 %	2,571	54 %	72 %	1,302	56 %	79 %	473	53 %	86 %
Male	1,970	43 %	61 %	3,727	47 %	63 %	2,496	46 %	70 %	2,197	46 %	70 %	1,005	44 %	78 %	423	47 %	78 %
	4,574			7,864			5,467			4,768			2,307			896		
White	2,604	61 %	69 %	5,155	71 %	68 %	3,681	74 %	73 %	3,113	73 %	71 %	1,422	70 %	79 %	521	66 %	82 %
Asian	156	4 %	76 %	305	4 %	72 %	266	5 %	76 %	306	7 %	78 %	214	11 %	79 %	94	12 %	90 %
Hispanic	422	10 %	67 %	555	8 %	64 %	381	8 %	72 %	313	7 %	69 %	146	7 %	71 %	65	8 %	78 %
Black	607	14 %	47 %	534	7 %	44 %	269	5 %	64 %	187	4 %	60 %	76	4 %	75 %	28	4 %	79 %
Native American	89	2 %	67 %	145	2 %	61 %	90	2 %	73 %	84	2 %	63 %	21	1 %	71 %	6	1 %	33 %
Pacific Islander	35	1 %	69 %	45	1 %	64 %	24	0 %	79 %	25	1 %	80 %	12	1 %	75 %	0	0 %	0 %
Multiracial	305	7 %	69 %	473	7 %	64 %	244	5 %	71 %	188	4 %	69 %	63	3 %	75 %	20	3 %	80 %
Foreign/International	39	1 %	79 %	51	1 %	90 %	38	1 %	92 %	57	1 %	86 %	78	4 %	79 %	55	7 %	84 %
	4,257			7,263			4,993			4,273			2,032			789		
Age: 19 & less	1,386	30 %	65 %	2,383	30 %	66 %	1,497	27 %	69 %	1,313	27 %	68 %	422	18 %	73 %	115	13 %	81 %
20-24	1,021	22 %	64 %	1,966	25 %	65 %	1,460	26 %	68 %	1,345	28 %	66 %	727	31 %	76 %	334	37 %	79 %
25-29	779	17 %	70 %	1,473	19 %	68 %	1,097	20 %	74 %	979	20 %	77 %	535	23 %	81 %	216	24 %	82 %
30-39	759	17 %	67 %	1,333	17 %	68 %	981	18 %	78 %	848	18 %	77 %	470	20 %	83 %	178	20 %	87 %
40-49	412	9 %	63 %	542	7 %	67 %	356	6 %	78 %	256	5 %	75 %	141	6 %	85 %	51	6 %	86 %
50+	233	5 %	72 %	239	3 %	59 %	128	2 %	78 %	72	1 %	69 %	35	2 %	80 %	10	1 %	80 %

TABLE P.6: Demographic data for 2010–2011 (College level MTH). Note that MTH 111A had 0 enrollment for 2010–2011, so its data is not displayed.

2010–2011	MTH 111 B&C			MTH 112			MTH 251			MTH 252			MTH 253			MTH 254		
	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass
Headcount	3,885			1,469		68 %	967		77 %	652		77 %	380		84 %	231		81 %
Female	1,971	51 %	73 %	487	34 %	67 %	266	28 %	77 %	134	21 %	78 %	74	19 %	85 %	55	24 %	84 %
Male	1,880	49 %	72 %	964	66 %	69 %	693	72 %	77 %	514	79 %	77 %	306	81 %	84 %	175	76 %	81 %
	3,851			1,451			959			648			380			230		
White	2,447	72 %	73 %	936	74 %	68 %	586	72 %	77 %	395	72 %	78 %	234	71 %	83 %	150	75 %	80 %
Asian	285	8 %	73 %	119	9 %	76 %	102	13 %	76 %	64	12 %	81 %	42	13 %	93 %	24	12 %	92 %
Hispanic	238	7 %	68 %	74	6 %	65 %	41	5 %	68 %	29	5 %	69 %	23	7 %	87 %	6	3 %	100 %
Black	147	4 %	59 %	30	2 %	47 %	18	2 %	56 %	10	2 %	60 %	3	1 %	100 %	5	3 %	60 %
Native American	57	2 %	58 %	10	1 %	90 %	9	1 %	78 %	7	1 %	43 %	2	1 %	100 %	1	1 %	100 %
Pacific Islander	14	0 %	86 %	3	0 %	100 %	3	0 %	33 %	1	0 %	0 %	1	0 %	100 %	0	0 %	0 %
Multiracial	132	4 %	73 %	53	4 %	57 %	23	3 %	70 %	18	3 %	67 %	6	2 %	50 %	4	2 %	75 %
Foreign/International	69	2 %	90 %	46	4 %	70 %	34	4 %	97 %	24	4 %	79 %	18	5 %	94 %	10	5 %	80 %
	3,389			1,271			816			548			329			200		
Age: 19 & less	967	25 %	74 %	466	32 %	65 %	244	25 %	77 %	152	23 %	79 %	81	21 %	86 %	39	17 %	82 %
20-24	1,152	30 %	68 %	385	26 %	63 %	266	28 %	76 %	188	29 %	72 %	102	27 %	85 %	72	31 %	82 %
25-29	826	21 %	74 %	310	21 %	75 %	225	23 %	81 %	163	25 %	81 %	114	30 %	82 %	67	29 %	79 %
30-39	669	17 %	75 %	234	16 %	71 %	177	18 %	72 %	113	17 %	77 %	63	17 %	89 %	43	19 %	91 %
40-49	209	5 %	75 %	61	4 %	72 %	47	5 %	81 %	33	5 %	67 %	18	5 %	78 %	9	4 %	56 %
50+	61	2 %	69 %	13	1 %	69 %	8	1 %	63 %	3	0 %	100 %	2	1 %	50 %	1	0 %	0 %

TABLE P.7: Demographic data for 2011–2012 (Pre-college level MTH and statistics)

2011–2012	MTH 20 Total	MTH 20 % Total	MTH 20 % Pass	MTH 60 Total	MTH 60 % Total	MTH 60 % Pass	MTH 65 Total	MTH 65 % Total	MTH 65 % Pass	MTH 95 Total	MTH 95 % Total	MTH 95 % Pass	MTH 243 Total	MTH 243 % Total	MTH 243 % Pass	MTH 244 Total	MTH 244 % Total	MTH 244 % Pass
Headcount	5,129			8,319			5,756			5,092			2,509			1,004		
Female	2,886	57 %	69 %	4,239	51 %	67 %	3,072	54 %	70 %	2,699	54 %	71 %	1,439	58 %	79 %	491	49 %	82 %
Male	2,198	43 %	61 %	4,009	49 %	64 %	2,625	46 %	71 %	2,343	46 %	68 %	1,053	42 %	77 %	505	51 %	80 %
	5,084			8,248			5,697			5,042			2,492			996		
White	2,843	60 %	68 %	5,175	68 %	67 %	3,685	70 %	71 %	3,241	70 %	70 %	1,569	71 %	78 %	585	66 %	83 %
Asian	160	3 %	79 %	293	4 %	72 %	238	5 %	78 %	316	7 %	72 %	223	10 %	83 %	103	12 %	90 %
Hispanic	440	9 %	70 %	587	8 %	67 %	412	8 %	74 %	327	7 %	69 %	124	6 %	75 %	47	5 %	74 %
Black	685	14 %	49 %	561	7 %	49 %	280	5 %	58 %	200	4 %	59 %	75	3 %	60 %	33	4 %	70 %
Native American	69	1 %	51 %	114	1 %	59 %	86	2 %	65 %	73	2 %	70 %	25	1 %	76 %	11	1 %	91 %
Pacific Islander	36	1 %	72 %	62	1 %	68 %	48	1 %	67 %	37	1 %	68 %	6	0 %	67 %	3	0 %	100 %
Multiracial	468	10 %	63 %	749	10 %	67 %	440	8 %	68 %	338	7 %	67 %	102	5 %	82 %	36	4 %	81 %
Foreign/International	44	1 %	82 %	72	1 %	82 %	62	1 %	79 %	74	2 %	85 %	93	4 %	82 %	73	8 %	78 %
	4,745			7,613			5,251			4,606			2,217			891		
Age: 19 & less	1,603	31 %	65 %	2,579	31 %	69 %	1,625	28 %	67 %	1,470	29 %	68 %	412	16 %	77 %	146	15 %	80 %
20-24	1,140	22 %	66 %	2,080	25 %	63 %	1,509	26 %	68 %	1,411	28 %	66 %	819	33 %	75 %	372	37 %	79 %
25-29	804	16 %	66 %	1,454	17 %	67 %	1,137	20 %	72 %	947	19 %	72 %	561	22 %	81 %	217	22 %	81 %
30-39	879	17 %	66 %	1,417	17 %	66 %	1,002	17 %	76 %	897	18 %	75 %	525	21 %	80 %	205	20 %	86 %
40-49	484	9 %	61 %	551	7 %	65 %	353	6 %	78 %	280	5 %	70 %	151	6 %	77 %	50	5 %	80 %
50+	218	4 %	67 %	237	3 %	55 %	129	2 %	73 %	87	2 %	70 %	41	2 %	80 %	14	1 %	86 %

TABLE P.8: Demographic data for 2011–2012 (College level MTH). Note that MTH 111A, B, and C courses were combined into MTH 111 starting in this AY.

2011–2012	MTH 111 Total	MTH 111 % Total	MTH 111 % Pass	MTH 112 Total	MTH 112 % Total	MTH 112 % Pass	MTH 251 Total	MTH 251 % Total	MTH 251 % Pass	MTH 252 Total	MTH 252 % Total	MTH 252 % Pass	MTH 253 Total	MTH 253 % Total	MTH 253 % Pass	MTH 254 Total	MTH 254 % Total	MTH 254 % Pass
Headcount	3,725			1,617			983			722			423			314		
Female	1,938	53 %	66 %	573	36 %	67 %	282	29 %	78 %	159	22 %	78 %	77	18 %	81 %	50	16 %	86 %
Male	1,747	47 %	67 %	1,035	64 %	70 %	691	71 %	76 %	559	78 %	77 %	345	82 %	80 %	263	84 %	86 %
	3,685			1,608			973			718			422			313		
White	2,393	72 %	67 %	1,059	75 %	69 %	620	74 %	78 %	454	73 %	79 %	266	73 %	78 %	192	75 %	90 %
Asian	259	8 %	74 %	116	8 %	67 %	72	9 %	72 %	52	8 %	75 %	34	9 %	94 %	25	10 %	88 %
Hispanic	209	6 %	57 %	64	5 %	67 %	46	5 %	65 %	42	7 %	79 %	19	5 %	63 %	14	5 %	86 %
Black	114	3 %	46 %	34	2 %	65 %	20	2 %	60 %	17	3 %	59 %	6	2 %	50 %	2	1 %	100 %
Native American	43	1 %	58 %	8	1 %	75 %	5	1 %	80 %	2	0 %	50 %	2	1 %	100 %	2	1 %	100 %
Pacific Islander	18	1 %	50 %	2	0 %	0 %	2	0 %	50 %	2	0 %	50 %	1	0 %	100 %	2	1 %	50 %
Multiracial	204	6 %	66 %	81	6 %	68 %	43	5 %	63 %	27	4 %	81 %	21	6 %	57 %	6	2 %	100 %
Foreign/International	83	2 %	75 %	43	3 %	77 %	35	4 %	86 %	26	4 %	81 %	16	4 %	81 %	12	5 %	67 %
	3,323			1,407			843			622			365			255		
Age: 19 & less	1,023	27 %	67 %	482	30 %	67 %	252	26 %	77 %	178	25 %	84 %	87	21 %	80 %	57	18 %	84 %
20-24	1,081	29 %	62 %	449	28 %	65 %	270	27 %	75 %	206	29 %	70 %	117	28 %	73 %	88	28 %	80 %
25-29	723	19 %	71 %	325	20 %	73 %	223	23 %	74 %	168	23 %	78 %	111	26 %	84 %	85	27 %	88 %
30-39	666	18 %	69 %	276	17 %	74 %	182	19 %	81 %	130	18 %	81 %	84	20 %	85 %	64	20 %	94 %
40-49	181	5 %	65 %	72	4 %	72 %	43	4 %	74 %	31	4 %	65 %	17	4 %	76 %	17	5 %	88 %
50+	48	1 %	60 %	13	1 %	62 %	13	1 %	69 %	9	1 %	78 %	7	2 %	71 %	3	1 %	100 %

TABLE P.9: Demographic data for 2012–2013 (Pre-college level MTH and statistics)

2012–2013	MTH 20			MTH 60			MTH 65			MTH 95			MTH 243			MTH 244		
	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass
Headcount	4,534			7,505			5,615			5,105			2,287			885		
Female	2,545	57 %	69 %	3,840	52 %	68 %	2,987	54 %	71 %	2,735	54 %	69 %	1,334	59 %	77 %	479	54 %	86 %
Male	1,926	43 %	62 %	3,599	48 %	64 %	2,583	46 %	69 %	2,322	46 %	68 %	939	41 %	76 %	402	46 %	82 %
	4,471			7,439			5,570			5,057			2,273			881		
White	2,400	57 %	67 %	4,622	67 %	68 %	3,503	68 %	71 %	3,187	68 %	70 %	1,440	69 %	78 %	516	67 %	83 %
Asian	151	4 %	87 %	296	4 %	76 %	262	5 %	74 %	313	7 %	76 %	187	9 %	79 %	85	11 %	84 %
Hispanic	403	10 %	73 %	553	8 %	67 %	422	8 %	69 %	339	7 %	65 %	122	6 %	71 %	54	7 %	85 %
Black	634	15 %	52 %	533	8 %	50 %	296	6 %	56 %	215	5 %	58 %	62	3 %	61 %	23	3 %	83 %
Native American	64	2 %	61 %	87	1 %	62 %	66	1 %	64 %	73	2 %	58 %	22	1 %	68 %	9	1 %	89 %
Pacific Islander	45	1 %	69 %	57	1 %	65 %	32	1 %	56 %	36	1 %	64 %	10	0 %	70 %	3	0 %	100 %
Multiracial	488	12 %	64 %	737	11 %	64 %	542	10 %	68 %	467	10 %	65 %	142	7 %	70 %	47	6 %	83 %
Foreign/International	26	1 %	85 %	50	1 %	92 %	39	1 %	77 %	54	1 %	89 %	88	4 %	83 %	37	5 %	92 %
	4,211			6,935			5,162			4,684			2,073			774		
Age: 19 & less	1,384	31 %	67 %	2,374	32 %	71 %	1,610	29 %	68 %	1,465	29 %	68 %	406	18 %	81 %	132	15 %	90 %
20-24	996	22 %	68 %	1,807	24 %	63 %	1,482	26 %	69 %	1,412	28 %	65 %	712	31 %	74 %	334	38 %	80 %
25-29	679	15 %	63 %	1,254	17 %	67 %	1,029	18 %	70 %	924	18 %	71 %	518	23 %	76 %	174	20 %	81 %
30-39	785	17 %	67 %	1,293	17 %	64 %	981	17 %	72 %	900	18 %	71 %	454	20 %	80 %	181	20 %	87 %
40-49	458	10 %	60 %	547	7 %	61 %	369	7 %	75 %	324	6 %	72 %	158	7 %	74 %	47	5 %	94 %
50+	232	5 %	66 %	230	3 %	54 %	143	3 %	73 %	79	2 %	67 %	39	2 %	74 %	17	2 %	88 %

TABLE P.10: Demographic data for 2012–2013 (College level MTH).

2012–2013	MTH 111			MTH 112			MTH 251			MTH 252			MTH 253			MTH 254		
	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass	Total	% Total	% Pass
Headcount	4,278			1,613			1,060			710			446			219		
Female	2,167	51 %	63 %	540	34 %	69 %	273	26 %	79 %	173	24 %	79 %	98	22 %	80 %	44	20 %	80 %
Male	2,079	49 %	66 %	1,060	66 %	71 %	776	74 %	79 %	534	76 %	75 %	347	78 %	81 %	174	80 %	83 %
	4,246			1,600			1,049			707			445			218		
White	2,696	69 %	66 %	1,025	70 %	71 %	647	69 %	79 %	444	72 %	76 %	281	75 %	81 %	142	74 %	85 %
Asian	279	7 %	72 %	146	10 %	73 %	103	11 %	79 %	52	8 %	73 %	29	8 %	76 %	17	9 %	71 %
Hispanic	260	7 %	60 %	68	5 %	72 %	44	5 %	82 %	32	5 %	63 %	18	5 %	78 %	8	4 %	88 %
Black	164	4 %	50 %	41	3 %	61 %	20	2 %	60 %	13	2 %	46 %	5	1 %	80 %	3	2 %	67 %
Native American	60	2 %	50 %	18	1 %	67 %	8	1 %	75 %	5	1 %	40 %	1	0 %	100 %	1	1 %	0 %
Pacific Islander	24	1 %	75 %	7	0 %	71 %	3	0 %	67 %	1	0 %	100 %	1	0 %	100 %	0	0 %	0 %
Multiracial	343	9 %	63 %	116	8 %	64 %	79	8 %	78 %	48	8 %	77 %	26	7 %	85 %	10	5 %	90 %
Foreign/International	95	2 %	72 %	37	3 %	92 %	34	4 %	94 %	24	4 %	83 %	13	3 %	69 %	11	6 %	73 %
	3,921			1,458			938			619			374			192		
Age: 19 & less	1,156	27 %	64 %	483	30 %	68 %	285	27 %	80 %	161	23 %	74 %	87	20 %	82 %	29	13 %	86 %
20-24	1,295	30 %	59 %	458	28 %	71 %	318	30 %	76 %	213	30 %	76 %	127	29 %	83 %	67	31 %	79 %
25-29	810	19 %	67 %	334	21 %	72 %	233	22 %	78 %	166	23 %	78 %	111	26 %	80 %	53	24 %	81 %
30-39	736	17 %	68 %	248	15 %	72 %	170	16 %	82 %	129	18 %	72 %	78	18 %	87 %	60	27 %	83 %
40-49	232	5 %	71 %	70	4 %	77 %	44	4 %	77 %	32	5 %	81 %	23	5 %	83 %	9	4 %	89 %
50+	49	1 %	69 %	20	1 %	75 %	10	1 %	70 %	9	1 %	78 %	9	2 %	78 %	1	0 %	100 %

12–2013)?