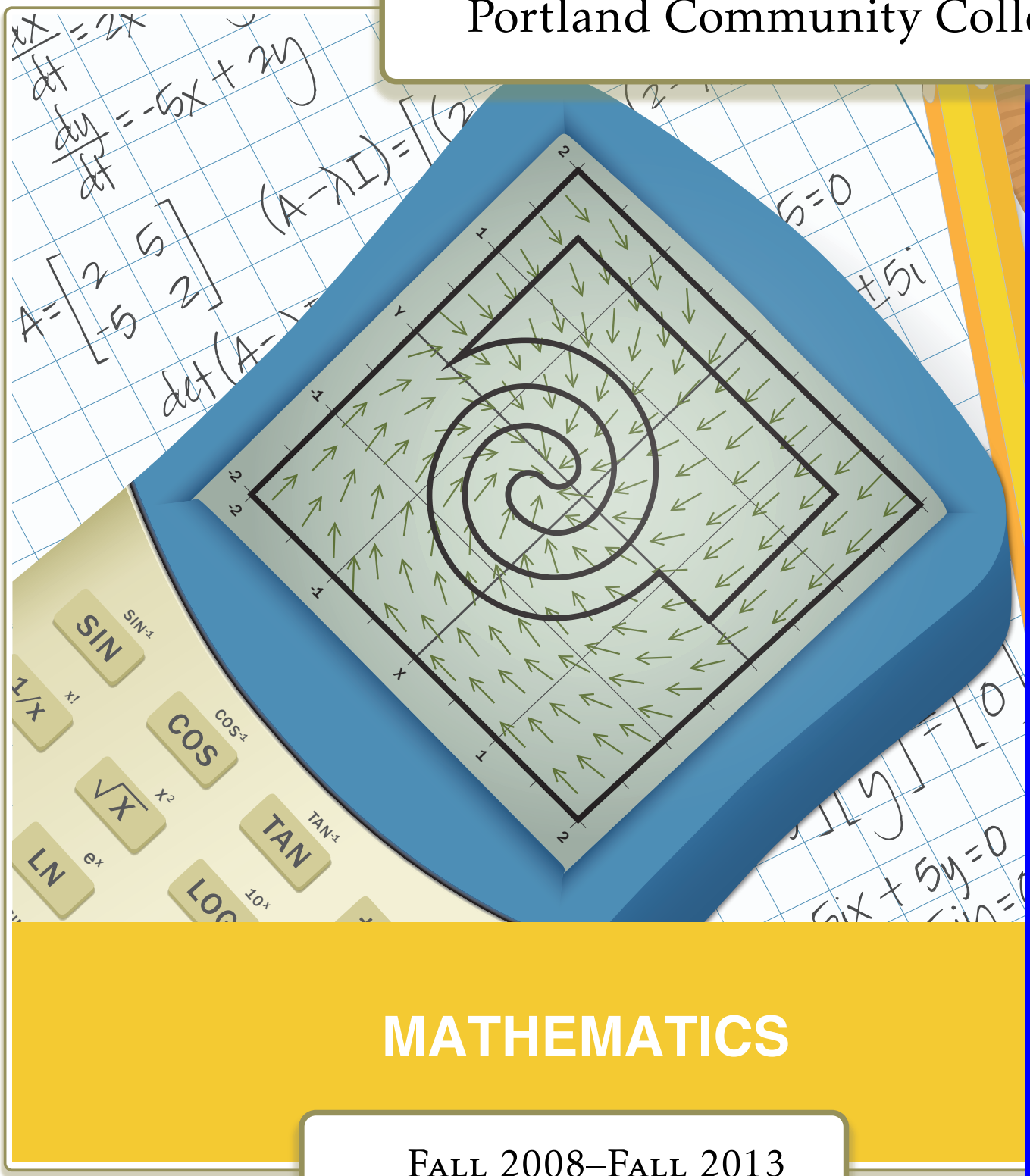
Program Review

Mathematics

Portland Community College



MATHEMATICS

Fall 2008–Fall 2013

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Needs of Students and the Community

definitiondiversity⟩

How is instruction informed by student demographics?
In order to answer this question, we decided that we needed demographic categories 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 87.

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 diversity statement as a point of reference:

> *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 reports

> *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, and reports

> *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 subcommittees 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 adequate release time. For more information, see **??** .

We actively pursue free and open source products such as WeBWorK—the fully accessible online homework system (see page 21). 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.

Educational Background

We have several projects and classes in place to address our students' different educational backgrounds. **??** contains information on some of our initiatives.

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 85).

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.

⟨needs:sec:trends⟩

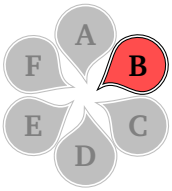
Data Trends

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 underrepresented populations. We have displayed data for five years in appendix P on page 113; 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.

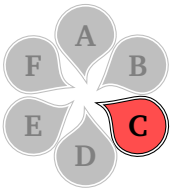


Have there been any notable changes in instruction due to changes in demographics since the last review?

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.



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 4.1, and its counterpart by campus in Figure I.2 on page 77 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 2011/12 due to a lack in facility space—see Table 4.1.

FIX

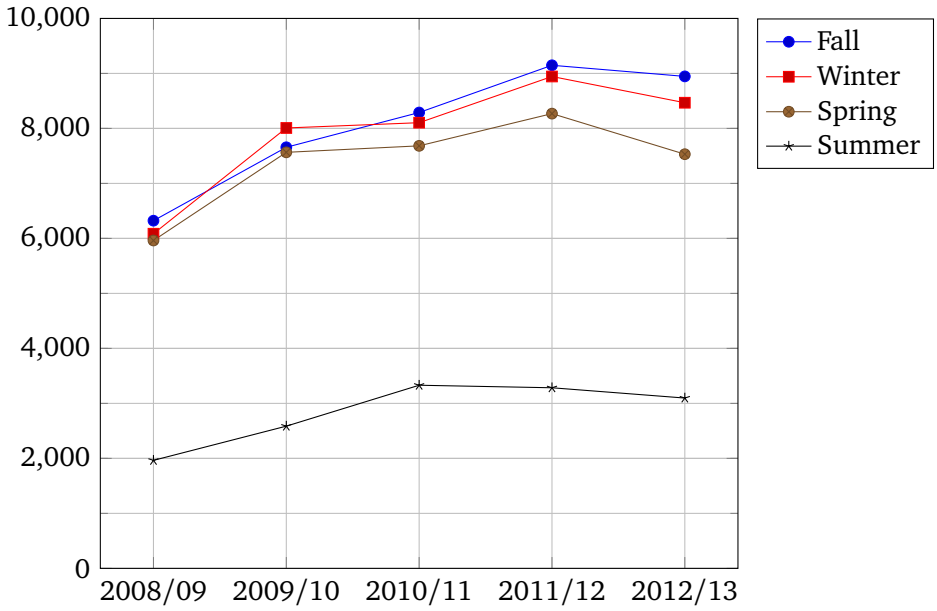


FIGURE 4.1: Enrollment in Developmental MTH by Term

rollmentDevelopTerm⟩

TABLE 4.1: Developmental Mathematics by Campus

ab:enrollmentDevelp⟩

	2008/09	2009/10	2010/11	2011/12	2012/13	% change 2008/09 – –2011/12	% change 2011/12– –2012/13
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%

Lower Division Transfer Mathematics

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 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 4.2 with its per-campus counterpart in Figure I.4 on page 78.

In particular, five-year enrollment increases in LDC are large at all campuses, as shown in Table 4.2. 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.

Totals (Developmental and LDC Combined)

Overall enrollment increased from AY2008 to AY2011 by 63%. This significant increase reflects the downturn of the economy five years ago. Many students returned to school because their jobs had ceased to exist or they hoped to better their chances of employment with a degree or certificate. There was a slight decrease (2%) in overall enrollment from AY2011 to AY 2012, which is mainly due to a decrease in enrollment in developmental mathematics courses (see Figure I.5 on page 78).

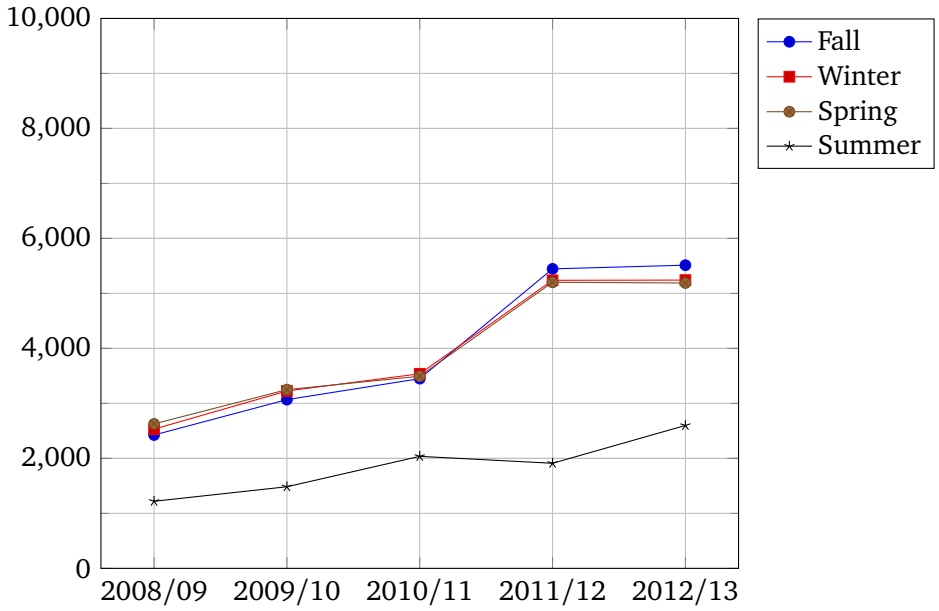


FIGURE 4.2: Enrollment in LDC, College Wide, by term

eds:fig:enrollmentLDCTerm⟩

TABLE 4.2: LDC enrollment by campus

s:tab: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%

Each campus experienced slightly different enrollment trends. Enrollment increases at CA and SEC from 2008-2011 were significantly higher than other campuses. SEC experienced a 92.33% increase in enrollment over the 4 year period and a continued enrollment increase from AY2011 to AY2012. RC experienced the lowest % drop (of campuses whose enrollment dropped) in enrollment from AY2011 to AY2012 (see Table 4.3 and Figure I.6 on page 79).

TABLE 4.3: Enrollment by campus and year

tab:enrollmentcampusyear⟩

	AY2008	AY2009	AY2010	AY2011	AY2012	% change 2008-2011	% change 2011-2012
SY	10860	13038	14252	16855	16137	55.20%	-4.26%
CA	5656	7781	8005	9740	9322	72.21%	-4.29%
RC	9545	11658	12643	14931	14878	56.43%	-0.35%
ELC	3076	4367	5025	5916	6247	92.33%	5.59%

Furthermore, while enrollment (number of students) has increased over a five-year period by 60%, the number of sections offered has not kept pace (only increased by 40%) as detailed in Table 4.4. We are concerned that the average class size is increasing.

While the average class size is somewhat small, there are classes that are much larger than the average. There is little consistency between campuses when it comes to class size, which seems

TABLE 4.4: Average class sizes (district wide)

ab:averageclasssize⟩

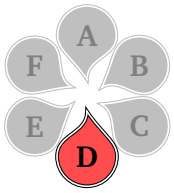
Year	Average Class Sizes
AY2008	24.87
AY2009	27.64
AY2010	27.36
AY2011	28.7
AY2012	28.4

to be determined almost entirely by room choice. Previous attempts at setting SAC-wide class sizes were not accepted by the Deans of Instruction. We have resubmitted our report and are awaiting a response—the report can be viewed in full in appendix O on page 93.

The ratio of Pre-College to LDC enrollment has decreased (see Figure I.7 on page 79). e are unsure of the reason for the decline in this ratio, but we are concerned that our completion rates have decreased, especially in developmental mathematics. Our overall success rates have decreased with increased enrollment. This could partially be explained by the large number of underprepared students who entered the institution as a result of the economic recession—see Table I.1 on page 76.

Of concern is that while enrollment has increased from 2008 to 2013, hiring of full time faculty has not kept pace. In addition, the demands on full time faculty (subcommittee work, LAS, CIC, ... etc.) have increased. However, if the economy continues to improve, it is expected that enrollment will level off or slightly decline for a short period of time.

Since Governor Kitzhaber proposal for the state of Oregon to have 40% of adults earn a bachelors or higher degree, 40% with an Associates, and 20% with a high school or equivalent degree there is concern how we will handle enrollment demands as policies to meet these goals are implemented. Classroom space, faculty workload, class size and student preparedness are all major concerns.



What strategies are used within the program/discipline to facilitate access and diversity?

The MTH SAC uses several strategies to facilitate access and diversity. For example, we offer all-day classes, hybrid classes, distance learning classes and Weekend College. This allows students who aren't available for traditional weekday classes to access the mathematics program at PCC.

We facilitate access to students who learn differently or would like a different learning structure by offering Alternative Learning Center (ALC) self-paced math classes (see appendix A on page 59).

We offer MTH 07/08 (aka AMP) to returning students who are not happy with their placement exam scores. This one-week intensive math review program is designed to help students place into higher level MTH courses which saves students time and money. It also facilitates quicker access to a degree if students are able to place higher and shorten their time in the developmental sequence. Even if students do not place into a higher course, it seems to help students fill in gaps in their knowledge.

The MTH SAC had a large project centered around accessibility of online content for students with disabilities. Mathematics faculty members quickly realized that our subject matter presented unique complications not faced by other disciplines. Chris Hughes and Scot Leavit were granted

release time to investigate accessibility as it applies to mathematics. We are grateful for the support and the collaborative nature of the project. The full text of the report, including recommendations made to the SAC, can be found at [9] and a summary is given in appendix G on page 72.

As a result of the project, faculty awareness of accessibility has increased significantly. It has also lead to discussions surrounding adoption of commercial online homework management systems (see details of the ALEKS pilot in appendix H on page 74) and an increased acceptance of WeBWorK as an online homework tool. which is currently the only fully accessible online homework management system. There has been considerable work done to develop problem libraries for Math 60/65 in WeBWorK that match our curriculum (see page 21).

Most faculty feel that we need further education on how to facilitate access and diversity in mathematics classes. In particular we would like further discussion and training on the various types of accessibility challenges that we face, including physical accessibility, learning accessibility, cultural and social accessibility and access to education.

Physical accessibility

Many of our instructors have some experience serving students that have either a visual or hearing disability. We appreciate the continued relationship and communication with the disabilities services on this issue. Most of our issues of physical accessibility within the classroom are handled well by disability services.

However, it is worth noting that on a SAC level, we face issues of accessibility in the facilities we use for our meeting space. As one of the largest SACs in the district, we often have trouble finding room space that is large enough to accommodate our group and is accessible at the front of the room. It is our understanding that the bond renovations will mostly address this issue.

Learning accessibility

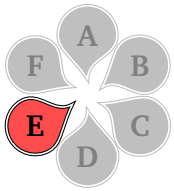
We would like continued training on how to provide equally effective instruction for students with learning disabilities. We think that quarterly workshops (perhaps offered through disability services) could help us to be proactive and learn about methods that are specific to the teaching of mathematics.

Cultural and Social Accessibly

Given our observations on page 36, we realize that we need further education, research, and training in strategies to provide equally effective instruction to students of all cultures, genders, and other facets (see our definition of diversity on page 34).

Access to education

Access to Education for historically underrepresented populations. We need more support to facilitate topics of social justice in a mathematics classroom. We feel that students should know how to use mathematics as a tool for social change; our social justice workgroup is a step in the right direction. We are currently working on disseminating the activities and the discussions from this group and sharing them with the larger SAC.



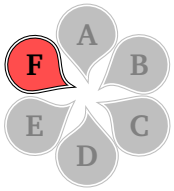
Describe the methods used to ensure faculty are working with Disability Services to implement approved academic accommodations?

During the 2012/2013 academic year, the Office of Students with Disabilities went to a paperless notification system for all academic accommodation notifications. Initially, this change to email

notifications led to several problems. One problem arose from the fact that not all faculty, especially part-time faculty, are as diligent in monitoring their PCC email as is necessary to make an email notification system work efficiently. More problematic, there were glitches in PCC's email system that led to many of the notifications being misdirected to quarantine or spam folders. As a result, there were students who had approved accommodations of which their instructors were unaware.

To help remedy this situation, the mathematics department chairs contacted the Office of Students with Disabilities and asked if there were some way that a back-up system could be created to catch notifications that have fallen through the cracks. In response, Kaela Parks (director of the OSD) has created a spaces page that lists every course in which there is at least one student enrolled who has approved accommodations. Kaela had the foresight to create a page that updates in real time. For example, if a student has made an accommodated testing request but the instructor has not yet completed the accommodated testing form, that class is flagged in red and the relevant department chair can contact the faculty member to let them know about the situation.

On another note, there had been growing concern among several faculty members about the nature of many accommodations. Some of the accommodations that caused concern had to do with things like calculator usage that completely contradict assessment criteria stated in course CCOGs. Another concern were accommodations that require flexibility in due dates (which can lead to the withholding of keys for other students). Kaela Parks came to a mathematics SAC meeting to discuss these concerns, and she assured us that these accommodations only need to be applied in reasonable ways. She also said that affected faculty can always contact her or the student's assigned OSD counselor to discuss specific accommodations of concern.



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

Mathematics support for Career Technical Education (CTE) has evolved over the years. Currently CTE students take mainstream math courses to fulfill their math requirement. Of concern at PCC, other academic institutions, and officials in the State of Oregon is the benefit gained by taking courses meant for the general student population. Current issues involve: should PCC create math courses focused on CTE students only, how would students transfer between these courses and the general mathematics curriculum. The following is taken from [13].

> *The research we did revealed a major gap in the alignment between the mathematics courses taught in the mathematics departments in our community colleges and the mathematics actually needed to be successful in the applied programs students are taking.*

Research to develop a CTE-MTH alternative track was underway but has stopped due to lack of clear direction and funding. The hope is that a CTE math alternative track will provide more meaningful content.

We believe that CTE-MTH alternative track will increase completion rates for CTE students. However, we need adequate financial support for this alternative path.

The CTE-MTH track will also address concerns from CTE programs that our classes do not properly prepare their students for the mathematics that is used in their programs.

On another note, the MTH 243 curriculum credit hour change was initiated by student feedback.

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