

# Comprehensive Program Review Developmental Math Program Fall 2012

## Success/Retention Analysis and Equity Analysis

### Developmental Mathematics Program Spring 2010 – Fall 2012

Success rates have varied from 53% to 61%. Our most recent success rate of 53% in Fall 2012 represents a drop of about 4% from the Spring 2010 semester. See table below.

#### Success Rate by Ethnicity

SEC TERM Course	African American		Asian		Filipino		Hispanic		Native American		Non-Respondent/ Declined		Pacific Islander		White		Total	%
2010SP	256	42.6%	57	57.6%	68	66.7%	359	58.7%	11	68.8%	149	56.9%	19	63.3%	414	65.9%	1333	56.7%
2010FA	223	43.6%	59	62.8%	70	57.9%	340	54.0%	17	65.4%	97	54.8%	10	38.5%	425	66.3%	1241	55.7%
2011SP	245	43.4%	51	62.2%	66	66.0%	367	52.2%	12	66.7%	76	51.0%	12	60.0%	418	64.3%	1247	54.5%
2011FA	287	53.4%	72	67.9%	62	62.6%	420	61.9%	11	61.1%	50	54.9%	8	42.1%	377	66.5%	1287	60.8%
2012SP	207	43.8%	66	67.3%	58	59.2%	373	58.8%	20	66.7%	49	60.5%	12	50.0%	355	66.2%	1140	57.8%
2012FA	173	45.8%	49	58.3%	43	66.2%	256	53.8%	12	80.0%	21	43.8%	5	31.3%	170	57.8%	729	53.0%

Non-white seat count has varied from 71% to 79%. The most recent seat count for non-white students of 79% in Fall 2012 represents an increase of about 6% from the Spring 2010 semester.

Our two largest groups on non-white students are African American and Hispanic. African American seat count has varied from 23% to 28% with our latest count of 28% in Fall 2012 representing an increase of 2% from the Spring 2010 semester. Hispanic seat count has varied from 26% to 35% with our latest count of 35% in Fall 2012 representing an increase of 9% from the Spring 2010 semester. See table below.

#### Seat Count by Ethnicity

SEC TERM Course	African American		Asian		Filipino		Hispanic		Native American		Non-Respondent/Declined		Pacific Islander		White		Total
2010SP	601	25.6%	99	4.2%	102	4.3%	612	26.0%	16	0.7%	262	11.1%	30	1.3%	628	26.7%	2350
2010FA	512	23.0%	94	4.2%	121	5.4%	630	28.3%	26	1.2%	177	7.9%	26	1.2%	641	28.8%	2227
2011SP	565	24.7%	82	3.6%	100	4.4%	703	30.7%	18	0.8%	149	6.5%	20	0.9%	650	28.4%	2287
2011FA	537	25.4%	106	5.0%	99	4.7%	679	32.1%	18	0.9%	91	4.3%	19	0.9%	567	26.8%	2116
2012SP	473	23.9%	98	5.0%	98	5.0%	635	32.2%	30	1.5%	81	4.1%	24	1.2%	536	27.1%	1975
2012FA	378	27.5%	84	6.1%	65	4.7%	476	34.6%	15	1.1%	48	3.5%	16	1.2%	294	21.4%	1376

## Success, retention, and persistence in Mathpath pilot cohorts 1 and 2

In the Curriculum section below we describe our efforts to accelerate students' pathways through developmental courses. One such effort is the Mathpath program, which combines Elementary Algebra and Intermediate Algebra in one semester. Following is data from the 4-semester pilot conducted in 2010-2012. Overall, students complete Mathpath at much higher rates than semester-length classes. There is also some evidence that these students take college level math courses at higher rates as well, though more longitudinal data is needed.

**This table shows retention, success, and persistence, as well as some data on college-level math course taking.**

	Cohort 1	Cohort 2	Notes
Enrollment in Elementary Algebra	31	30	Developmental class caps are 32.
Retention	29/31 (93.5%)	30/30 (100%)	1 student stopped attending, but did not formally drop. (Military deployment.)
Success	28/31 (90.3%)	28/30 (93.3%)	C1: 1 incomplete. C2: 2 students did not take the final: 1 who stopped attending and 1 who was given an incomplete (health).
Persistence to Intermediate Algebra	25/31 (80.6%)	28/30 (93.3%)	C1: 2 health, 1 job
Retention	25/25 (100%)	28/28 (100%)	
Success	25/25 (100%)	26/28 (92.9%)	C1: 80.6% of students who started the semester completed the entire 2-course program C2: 86.7% of the students who started the semester completed the entire 2-course program
Completion of college-level math	13	10	C1: Of the 25 who completed the program, 4 indicated they were pursuing AA/certificates. Therefore the program served to fulfill their math requirements. By spring 2012 (3 semesters out) 42% of the students who started the program had completed a transfer level math course. If we take out the 4 AA/cert-aiming students, 48% of the students met their math goals.  C2: Of the 28 who completed the program, 5 indicated they were pursuing AA/certificates. Therefore the program served to fulfill their math requirements. By spring 2012 (2 semesters) 33% of the students who started the program had completed a transfer level math course. . If we take out the 5 AA/cert-aiming students, 40% of the students met their math goals.

Currently we have less data from the third and fourth cohorts of the pilot, but we know the following:

- 29 students enrolled in Cohort 3 in Fall 2011 and 23/29 passed Math 25 (79.3%)

- Of these students, 17/23 passed Math 30 (73.9%)
- In spring 2012/summer 2012 7 of these 17 students completed Math 34 and 1 completed Math 40.
- Only 13 students enrolled in Cohort 4 in Spring 2012, and 11/13 (84.6%) passed Math 25.
- These 11 students enrolled in Math 30, plus one additional student, so 12 total students enrolled in Math 30.
- One student dropped, so retention was 11/12 (91.7%)
- Those 11 students passed Math 30 (91.7% success)
- We do not have further data from this cohort.

Similarly, consider data from our accelerated path to Statistics. The table below shows completion and success from the first two cohorts. As described in the Curriculum section below, this course prepares students for Statistics in one semester.

**Algebra for Statistics completion and success data:**

TERM	COMP. RATE	SUCC. RATE
2009FA	96.55%	75.86%
2010FA	100.00%	100.00%
2010FA	87.50%	87.50%
2010FA	92.31%	84.62%

**Comparison with Semester-length math courses:**

For comparison, the table below shows retention and success in semester-length Algebra courses. In line with findings from acceleration research, these rates are much lower than in accelerated pathways.

TERM	COURSE	Retention rate	Success rate
2009FA	Elementary Algebra	74.57%	56.87%
2009FA	Intermediate Algebra	77.42%	54.99%

**Completion of transfer level math:**

- From Fall 2009: 17% of students in Math 25 completed a transfer level course by summer 2011, and 33% of students in Math 30 completed a transfer level course by summer 2011.

## Curriculum Update and Course Offering Analysis

In the past five years the program has discontinued courses (Math 9, 15, and 18), created new courses (Math 24, 27, 28, 29), and updated/created course outlines for all courses that we offer. Further, all courses have learning outcomes that align with the program's learning outcomes, and several of our courses have specialized curricula written by department faculty.

In this time program faculty have made a commitment to accelerating students' pathways through DE courses. Several key factors have influenced our work:

- (1) Associates degree requirement: previously, students could fulfill their AA/AS math requirements with Elementary Algebra (Math 25) or several other courses we offered at the same level. State requirements changed such that students must now complete Intermediate Algebra (Math 30) or a course at the same level (i.e., Math 25 as a prerequisite) to earn an AA/AS degree.
- (2) The length of the pathway: if a student enters the DE program at the arithmetic level, and then proceeds through Pre-Algebra, Elementary Algebra, and Intermediate Algebra, then it takes two years at minimum to fulfill the AA/AS requirement and to reach Transfer level math. It has been well documented both by educators and researchers in developmental mathematics education that this pathway functions as a "hemorrhaging pipeline" (Hern, 2010). That is, few students make it all the way through the sequence of courses. This is especially true for low-income students, students of color, and students who are the first in their families to attend college.

Given these facts, we have not only made a commitment to acceleration, but we have piloted accelerated programs/courses, created professional development for teaching acceleration, and instantiated these courses as part of our regular offerings. These efforts include:

- The Mathpath Program: based on the successful Mathpath Program at Pasadena City College, we conducted a 4-semester pilot of this program that allows students to complete Elementary and Intermediate Algebra in one semester, along with a support course. During this pilot two full time faculty and three adjunct faculty were involved in teaching the mathematics and support courses. As shown above, the completion rates for these sections are significantly higher than our standard semester length courses. After the pilot, we decided to discontinue the support courses, and instead offer support via scheduled lab hours with a second teacher. Therefore Mathpath students have the support from two teachers without a third course. Further, Mathpath has been offered twice in conjunction with the Umoja Scholars Program with similar success.
- Accelerated Elementary and Intermediate Algebra: This 7-unit course combines Elementary and Intermediate Algebra in one semester. We began piloting this course in Spring 2012 as an experimental course (Math 910), and as of Fall 2013 the course is officially instantiated in our offerings as Math 29. Two full time faculty members conducted the pilot, and as of Spring 2013 the course has been taught by these two faculty and one adjunct faculty member.
- Algebra for Statistics: this course was piloted in 2009, and as of 2013 it has been instantiated in our offerings as Math 27. Three full time faculty and two adjunct faculty have participated in professional development and in teaching this course. Math 27 offers

students the opportunity to complete their developmental math requirements in one semester before moving on to transfer level statistics. Initially the course was run in conjunction with the Puente program, and has also been offered with the ACE program.

These courses are included in the table below. Currently the Developmental Math Committee is working on determining how many sections to offer of each accelerated course and how to communicate these options to students, faculty, and counselors.

Course #	Description	Pre- and co-requisites	COOR	Curriculum	Offerings
Math 4	An arithmetic course designed to help students develop study skills and confidence in math	<i>None</i>	Current	A faculty member Jeannine Stein has worked with the publisher of a textbook to include study skills assignments within the textbook	Over the past few years we have decreased the number of sections of this course. Currently we offer 3 sections per semester.
Math 7	A self-paced course to help students develop arithmetic skills in context	<i>None</i>	Current	Students use an online curriculum, and the course has been offered both face-to-face and as a hybrid.	For several semesters we have offered one section. After Spring 2013 this course will no longer be offered.
Math 12	A Pre-Algebra course designed to prepare students for Elementary Algebra. Emphasizes problem solving, communication, and the use of multiple representations in the contexts	<i>None</i>	Current	Department faculty members have written a set of curriculum activities aligned to the CSLOs. This curriculum is supplemented with textbook, software, or skills worksheets.	At the start of this program review cycle the department and program were increasing, and we added several sections of this course. However, given budget constraints, we have now cut back those sections despite demand.
Math 24	Support course for Mathpath Math 25	Mathpath Math 25 (co)	Current	Faculty created activities for this course	We are currently not offering this course, but may in the future
Math 25	This 5-unit Elementary Algebra course emphasizes problem solving, communication, and the use of multiple representations in the contexts of linear and quadratic functions and models	Math 12, completion of coursework at another college that is comparable to Math 12, demonstration of equivalent prealgebra skills based on the LMC assessment process, or equivalent assessment recommendation from another college.	Current	Department faculty members have written a set of curriculum activities aligned to the CSLOs. This curriculum is supplemented with textbook, software, or skills worksheets.	At the start of this program review cycle the department and program were increasing, and we added several sections of this course. However, given budget constraints, we have now cut back those sections despite demand.

Course #	Description	Pre- and co-requisites	COOR	Curriculum	Offerings
Math 26	This is a plane geometry course that satisfies the AA/AS requirement	Math 25 or equivalent	Current	We have not developed specialized curriculum for this course, but we are researching textbook options	Within this program review cycle we have decreased offerings of this course, especially in the summer schedule.
Math 27	Algebra for Statistics prepares students for Transfer Level Statistics.	<i>None</i>	Current	Faculty created activities for this course	We have not offered this course in Spring 2013, but are planning to offer two sections in Fall 2013.
Math 28	Support course for Mathpath Math 30	Mathpath Math 30 (co)	Current	Faculty created activities for this course	We are currently not offering this course, but may in the future
Math 29	This accelerated course allows students to complete the material of Math 25 and 30. Meets AA/AS requirement.	Same as Math 25	Current	Department faculty members have written a set of curriculum activities aligned to the CSLOs. This curriculum is supplemented with textbook, software, or skills worksheets.	We have offered two sections of this course since the pilot began.
Math 30	This Intermediate Algebra course emphasizes problem solving, communication, and the use of multiple representations in the contexts of linear, exponential, logarithmic, and quadratic functions and models. Meets AA/AS requirement.	MATH-025 with a grade of "C" or better, or completion of coursework at another college that is comparable to MATH-025 with a grade of "C" or better, or demonstration of equivalent elementary algebra skills based on our LMC assessment process, or equivalent assessment recommendation from another college, or successful completion of high school Algebra II.	Current	Department faculty members have written a set of curriculum activities aligned to the CSLOs. This curriculum is supplemented with textbook, software, or skills worksheets.	At the start of this program review cycle the department and program were increasing, and we added several sections of this course. However, given budget constrains, we have now cut back those sections despite demand.

As of the Spring 2013 semester, the Math DE committee is also working on redesigning our Basic skills sequence of course, including potentially redesigning Math 4 as a quantitative literacy course. This work will likely lead to a revision of the course outline, the development of new curriculum, and professional development work.

## **Instructional Methodologies**

Course lecture hours will consist of the introduction of new concepts by the instructor, practice in group work of new concepts and reinforcement of existing material, student presentation of selected questions to show mastery, and (optional) discussion of in-class activities department curriculum modules.

During lecture, the instructor's role is to communicate the new topics through lecture, interaction with groups, and class discussion in a manner that reinforces and supports students' existing knowledge of course concepts. Additionally, the instructor's role is to support and encourage students in developing independent problem solving and critical thinking skills, and drawing appropriate conclusions regarding course concepts and problems.

Lab hours by arrangement will consist of lab assignments more in-depth and conceptual than homework assignments, completion of which requires instruction in the Math Lab. Lab assignments typically include continued topics from those discussed in class, and often involve realistic applicable scenarios.

During lab hours by arrangement, the instructor's role is to use the Socratic method to question students to stimulate mathematical thinking and support students in drawing the correct conclusions. When needed, the instructor should provide one to one instruction in conceptual areas the student is misunderstanding. By the end of the semester, the student should have an increased independence in problem solving and improved mathematical communication skills.

## **Assessment Summary**

As of the start of the Spring 2013 semester we have completed Course Level Assessments for Math 7, 12, 24, 25, 28, and 30, as well as a PSLO assessment utilizing the previously listed Course Level Assessments. We are in the process of completing assessments for Math 4, 26, 27, and 29.

While we do not have any plans to revise PSLOs, we have made use of the results of the Course Level Assessments to revise our common exam questions (which are often used as an assessment instrument), curricula, teaching strategies, and professional development plans.

## **Certificate and Degree Requirements**

Math 26 and 30 serve as AA/AS degree requirements. Math 7 and 12 serve certificate requirements, but after this academic year we will likely discontinue offering Math 7.

We are no longer offering Math 9 but have yet to remove it from the schedule of classes. Thus completion of Math 9 still satisfies the Math Certificate of Achievement. There was informal discussion around allowing Math 27 to fulfill the Associate Degree requirement but there has been no formal discussion and/or revision. On page 39 of the virtual catalogue, the Math Competency Exam should say two attempts instead of three.

## **Staffing Structure**

See 2012 Math Department Comprehensive Program review for this analysis.

## **Budget Analysis**

The Developmental Math program does not have a program budget separate from the Math department. Therefore readers should refer to the 2012 Math Department Comprehensive Program review for a budget analysis.

The program does, however, have ongoing funding for Teaching Communities. The total amount of this budget has not changed since it was instantiated after the Title III grant referenced above. The only change includes that the budget is now allocated to fund participation of adjunct faculty and no longer funds full time faculty participation.

## **Facilities**

In conjunction with the transfer math program, the developmental program faculty and students have benefitted during the last five years from a new building on the main campus, which includes offices, classrooms, a computer classroom, two computer labs, and a large math lab. Unfortunately, the building needs some repairs, and not all of the math classes are held in the building. For a full analysis, see the 2012 Math Department Comprehensive Program.

## **Equipment and Technology**

For a full analysis of equipment and technology use in the Math Department, see the 2012 Math Department Comprehensive Program.

For the Developmental Math program specifically, it would be beneficial to have TI graphing calculator emulator software available on all Smart stations in classrooms where Math courses are held. Math 30 instructors in particular make use of this software, and other instructors may choose to demonstrate with this software as well. In general it would benefit instructors and students if all Smart stations, document cameras, and student computers in the building function consistently.



## Professional Development

### I. Teaching communities

The Developmental Program in the Math Department has offered professional development in the form of teaching communities for over a decade. In the early 2000's the program began running teaching communities funded by a Title III grant, and applied for funds via the college's FPM process (RAP's precursor). Much of this early work utilized the Japanese model of lesson study, especially for examining and improving how we teach Math 25 (Elementary Algebra). This early work led to the current curriculum we have for Math 25, and a group that read Susan Lamon's *Teaching Fractions and Ratios for Understanding* began work that led to the current curriculum for Math 12 (Pre-Algebra).

Because of the success of this early work, the program received an exemplary program award from the state academic senate in 2007-2008, shown at the right.

Because the early teaching communities were part of the program's work that had been funded by a Title III grant, the college instantiated a budget for the department to offer teaching communities in an ongoing manner (as well as for the Developmental Program Leads). This has allowed the program to enculturate and support faculty in successfully implementing and assessing the curricula we have developed, which is tied to teaching to the program's learning outcomes.

From 2007-2009 much of this work used a modified version of Japanese lesson study. In the past few years we have worked to offer topics of interest and need to our DE instructors. Each semester's Teaching Community focuses on a topic related to pedagogical strategies and/or DE PSLOs. Below is a summary of the work we have done each semester from 2010-2013:



**Spring 2013:** this semester we are focusing on assessment and feedback. Specifically, faculty are working in pairs to: align assessments and assignments with course outlines; develop assessments and rubrics to give students feedback on their work related to learning outcomes; and engage students with feedback, towards learning.

**Fall 2012:** we focused on the role of questioning in teaching. We examined how we use Socratic questioning strategies in tutoring in the math lab and in leading class discussions, and how we use questioning as part of facilitating group work.

**Spring 2012:** we examined effective teaching practices to help students develop their skills and habits as effective learners. Topics included: supporting motivation, developing rapport, structuring groupwork for effective collaboration, and communicating with students about their performance.

**Fall 2011:** we examined the relationship between homework and effective learning. Building on the previous semester's work, we reflected on our beliefs about homework, and we developed teaching strategies related to (1) how we set students up to effectively engage with homework (2) how we assess homework and lab assignments and (3) how we communicate with students about their work.

**Spring 2011:** three communities formed this semester

- Math 12: Pre-Algebra instructors met to study Dan Apple's work and to develop activities for teaching fractions and integers. This work led to revisions of the Pre-Algebra curriculum.
- Math 25: Elementary Algebra instructors met to collectively plan and reflect on lessons using the department's Elementary Algebra curriculum module. Participants observed each other teach lessons in order to learn about different teaching strategies and to provide each other feedback.
- The third group focused on teaching practices designed to support students in making the most out of homework as a learning opportunity.

**Fall 2010:** two communities formed this semester

- Problem solving: this group focused on engaging students in problem solving. DE leads modeled how to facilitate problem solving in class, and then faculty tried out the teaching strategies in their own classes. In the teaching community we debriefed from these implementations, and analyzed case studies of students solving problems to better understand student thinking, towards further improving instruction.
- Homework and effective learning: this group focused on examining beliefs about the value of homework, as well as practices and policies, towards finding alignment between the two. The group investigated student perspectives as well, and designed new practices to support student homework engagement.

## II. Acceleration professional development

In fall 2010 the Math Department began a pilot of the Mathpath program, which allows students to complete Elementary and Intermediate Algebra in one semester. In spring 2012 we added another accelerated option that combined these two courses into one 7-unit course. In this time full time and adjunct faculty have worked collaboratively to develop and implement these courses. Initially this work was done on a volunteer basis, but through RAP we now have funds to do more formal professional development. Since 2012 we have provided further training, including: analysis of course outlines with respect to course pacing; observations of accelerated classes; meeting with students in these classes; discussion of the affective factors at play in the accelerated environment and classroom management; professional expectations in the and accelerated course schedules. It is a department priority to continue this work, towards preparing

more faculty members to teach these classes. In Spring 2013 we hope to additionally offer several Friday workshops on these topics.

Additionally, we have also offered students an accelerated pathway to Statistics. Towards developing our faculty to teach this course, two full time faculty and two adjunct faculty applied and were accepted to participate in 3CSN's 2012-2013 Community of Practice in Acceleration (COPA). They attended three statewide workshops. Following, they met monthly during Spring 2011 to prepare to teach Math 27 (Algebra for Statistics). One full time faculty member and one adjunct faculty member team taught this course in Fall 2012. This team continued to meet during the Fall 2012 semester..

We are planning for one full time faculty member and one adjunct faculty member to team teach Math 27 in the fall, with a second section to be taught by one of the remaining team members. To sustain the training and development of adjunct instructors the program will be requesting college funds.

### III. Individual professional development

In addition to the professional development work described above, individuals in the department have participated in various professional development activities, including: learning and implementing mathematical software in teaching; taking graduate courses and earning further degrees; reading mathematics education research; and attending and presenting at conferences and workshops.

### IV. Future priorities

Given the current work in the Developmental program, our priorities are acceleration, pedagogy, and aligning instruction with learning outcomes.

Additionally, given the program's current project of restructuring our Basic Skills offerings, we will be focusing some of our teaching community work on developing teaching expertise in our to-be redesigned Math 4 course.

## Collaboration

The Developmental Math Program has entered into many partnerships with other programs and departments at the college. These partnerships aim to increase opportunities for students within math and within their majors/career areas.

- We have collaborated with English and Psychology faculty to contextualize math courses for future teachers (The Teacher Preparation Learning Community)
- We have collaborated with CTE faculty to contextualize math courses for students in industrial trades
- We have collaborated with the ACE program, via Math 27
- We have an ongoing partnership with Child Development via First Five to offer courses to child development students
- We have an ongoing partnership between Counseling and Math 12
- We have an ongoing partnership with English and ESL faculty via the DE/ESL committee
- We have an ongoing partnership with the Umoja Scholars Program, as this program offers sections of DE courses, including Mathpath

## Annual Review Update Analysis

Our last review was deemed to either meet or exceed all institutional expectations. The feedback, overall, seems to indicate that when we completed the forms we put information in the wrong places. Perhaps we did not understand the definitions of institutional terms. For examples, the unidentified reviewers indicated that what we wrote as “rationales” were “activities” but that the “activities” are missing. We embedded “objectives” in the “status update” and we embedded “objectives” in the “rationale.”

There was also a suggestion to analyze equity based on data from Asian students.

## Strategic Priorities

Describe which strategic priorities (District or college) you feel are most applicable to your unit/program and how your unit/program plans to participate in supporting these priorities.

Priorities	Program plans
<b>College strategic priorities 1 and 3</b>	As described above the Developmental Math program has already piloted and implemented three accelerated options that we plan to continue to offer in an ongoing basis.
College strategic priority 4	The Developmental Math program will continue to support the Umoja Scholars program via sections offered, faculty participation, and space.

## Long Term Goals

Acceleration: instantiate accelerated offerings as an integral part of the program

Towards this goal the program committee is working on several related activities:

- determining the optimal proportion of courses to be offered as acceleration and offering this many accelerated courses
- training faculty to teach accelerated courses
- research and potentially offer additional accelerated courses
- recruiting and orienting students
- communicating with counselors about offerings

Basic skills: restructure current basic skills offerings to meet the needs of different constituencies of students

- Review and revise placement logistics
- Revise foundational course
- Train faculty to teach revised foundational course

Learning outcomes: align instruction in developmental math courses with course and program learning outcomes

- Continue assessment practices, which include creation and use of rubrics based on course student learning outcomes
- Continue to provide professional development related to pedagogy, curriculum, and assessment