

**PEIL Project Final Report**  
**ChaRM: Changing Remedial Math**  
**2014-2015**

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**EXECUTIVE SUMMARY:**

**Restructuring of the year-long developmental math sequence, ChaRM 805, 806 and 807**

- *Shift in culture to the requirement of “mastery” of math content versus learning enough to earn a passing grade.*
  - Each course has three exams and all three exams must be passed at the 85% level.
  - Students earn the right to take a makeup exam by completing a Worksheet with 100% accuracy.
  - Students given three attempts to pass each of the exams.
- *Change in pedagogical approach toward discovery and exploration, and away from straight lectures.*
  - Creation of classroom workbooks in which students actively construct math concepts leading to a deeper understanding of the material.
  - Use of manipulatives to increase student understanding of math concepts.
  - Use of online ALEKS program – which uses adaptive questioning, tailoring questions for each student. Again requiring “mastery” of the material versus a “passing grade.”
- *Provide greater support to instructors through an improved teacher training course, Math 6005\**
  - Written homework and checkpoints are the same across all sections.
  - Test bank to ensure consistency across sections.
  - Weekly meetings to discuss math concepts and effective ways of presenting the material for the subsequent week’s schedule.
  - Creation of a feedback loop to continually improve course materials and structure.

**Results**

- As expected, because of the 85% mastery requirement, Math 800 had a higher pass rate than ChaRM 805. However, those who repeated ChaRM 805 were more likely to pass the second time through than their 800 counterparts.
- The pass rate for ChaRM 806 was much higher than Math 900. If a student made it into ChaRM 806, then they were ready to be there. Their knowledge of the mathematical fundamentals was stronger than those entering Math 900.
- In all three ChaRM classes, the percentage of A/Bs are significantly higher than the comparable 800/900/950 courses. We required mastery in order to pass the course and thus the passing students really needed to know all of the material, resulting in high grades.

***Bottom Line: The full year run of ChaRM in 2014-2015 showed much promise and good results. We believe it is robust enough to be a permanent part of the developmental math program.***

## **OVERVIEW:**

One of the Institutional Learning Outcomes for students at CSUEB is to “think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and everyday problems.” Analytic and quantitative reasoning skills are integral to succeeding in a STEM major, and one of the core subjects required for all STEM careers is college-level algebra. Yet about 49% of our entering freshman require at least one quarter of developmental math, thus delaying entry into a gateway course for pursuing a major in a STEM field.

The pass rate for any level of developmental math, across the 23 CSUs, ranges from 40% to 80% and at CSUEB, in MATH 800, averages around 65%, depending on the quarter. Even those students who do pass the developmental math classes may not truly have a strong grasp of the material, as is evident when they continue taking classes in physics, chemistry, business, economics, statistics, and many more subjects. Typically these students may have struggled in their high school math sequences, and at college, they see the same material, taught in the same lecture-only mode, at a faster pace, and somehow are expected to have light bulbs go off in their heads regarding the material.

At CSUEB the Math and Computer Science Department (MCS) offers a three-quarter sequence in developmental math, with each course serving as a prerequisite for the next course in the sequence.

- *MATH 800 Introduction to Algebra:* fractions, signed numbers, percentages, introduction to geometry, simplifying algebraic expressions, solving linear equations, straight lines.
- *MATH 900 Elementary Algebra:* Operations with integers, exponents, order of operations, solving linear equations, operations with polynomials, operations with rational expressions, complex fractions, slopes and intercepts, solving and graphing inequalities.
- *MATH 950 Intermediate Algebra:* Operations with algebraic expressions, exponents and radicals; linear and quadratic equations; systems of equations and inequalities; linear and quadratic functions and their graphs; elementary conic sections; word problems.

The entry point for each student is based on his or her Entry Level Math (ELM) Exam score. A score of 50 or above means the developmental math flag is lifted and the student continues on to College Algebra or Trigonometry or higher, depending on background, SAT scores, etc. The grading for the developmental math courses is A, B, C, or no credit. Once students pass Math 950, the developmental math flag is lifted and they are free to take college-level classes for credit.

*Our goal was to improve not only the pass rate of our students, but also their inherent conceptual understanding of the material, reflected in a higher percentage of top grades. To achieve this, we proposed moving away from the traditional classroom where the teacher lectures, students learn and practice formulas, and hopefully absorb the material.*

## **STRUCTURE OF THE CHARM CLASS:**

The major components to any class are (1) how the material is organized, (2) the textbook, (3) the homework, and (4) the assessments. All four components in the ChaRM classes have been altered from the regular MATH 800/900/950 classes.

Organization of the material: Because students jump into the 800/900/950 sequence at multiple entry points, there is quite a bit of content repetition. Since ChaRM is a year-long sequence with one entry point, we organized the year’s worth of material into seventeen units with no overlap of content. This organization differs from the textbook in that, for example, order of operations appears many times throughout the textbook: first with integers, again with fractions, and again with decimals. We treat it once. These seventeen units are:

<b>ChaRM 805</b>	<b>ChaRM 806</b>	<b>ChaRM 807</b>
Unit 1: Fundamentals	Unit 8: Coordinate System	Unit 12: Rational Expressions
Unit 2: Integers	Unit 9: Slope and Linear Eqs	Unit 13: Sets and Functions
Unit 3: Fractions	Unit 10: Exponents and Polys	Unit 14: Absolute Value
Unit 4: Decimals	Unit 11: Factoring	Unit 15: Fractional Exponents
Unit 5: Percents		Unit 16: Quadratic Equations
Unit 6: Expressions		Unit 17: Problem Solving
Unit 7: Equations		

The Textbook: There is no formal textbook for the ChaRM classes. Rather, we have created the curriculum from scratch, based on our experiences and knowledge. The biggest difference between our curriculum and the textbooks is that they serve as in-class workbooks. Definitions, examples, and non-examples are included in the workbooks for reference, but a large majority of the “textbook” is work to be done in class, so that students immediately practice the material, or explore a new concept through exercises. This format has been used in all the professional development for K-12 teachers in which Prof. Olkin has been involved, and always receives high reviews for this methodology.

One of the key differences in the ChaRM classes is how the material is introduced. We try to use concrete materials (e.g. two-color chips for integers, algebra tiles for expressions and equations) so that students truly understand and internalize the underlying math concepts. Then we transition to a semi-concrete portrayal of the concrete material by using appropriate diagrams, and finally, move to the abstract. The unfolding of each new concept is handled by having students do explorations, looking for patterns on their own so that a “rule” is something they discover, rather than being told by the teacher. In this way, math concepts and rules fall into place in a meaningful way.

Homework: Predominantly, homework is handled online, to be completed regularly during the week. The online program is ALEKS, a web-based adaptive program that uses "artificial intelligence" to learn and adjusts its math questions based on the student performance. Students must master a skill set before moving on to the next skill set. Each Unit includes two or three written assignments, providing a chance to look over student work, to reinforce that the process is as important as the answer, and to ask more penetrating “why” questions. Additionally, each Unit contains several Checkpoints, providing a quick way for the instructor to check understanding from the class.

Assessments: Each class consists of three exams, each one covering approximately two Units. For consistency between sections, in order to ensure student preparation for future courses, these exams are pulled from a test bank. In order to pass the course, students must receive at least 85% on EACH exam. Thus, no content knowledge falls through the cracks. Every student sits for the first offering of the exam. If they don't pass they must complete a worksheet with 100% correct in order to show readiness for the make-up exam. Furthermore, if they don't pass the exam in it's first two offerings, then they can take the exam a third time during Finals Week. In this way, there is no “final exam.” This system appeals to students.

#### THE CHARM TEAM:

The team consisted of two professors in the Math and Computer Science Department, several Math Masters students, and two graduates from our Masters program. Here is what we each brought to the table.

Professors: Kevin Callahan and Julia Olkin both have years of experience in creating and giving professional development to K-12 teachers and creating curriculum for students. Julia has been the Principal Investigator (PI) on two California Math and Science Partnership grants, teaching 180 hours' worth of curriculum to 3<sup>rd</sup>-8<sup>th</sup> grade teachers. She is PI on the multi-year Math Achievement Academies, which provides summer support to students struggling in math. She serves as the CSU Director to Statway, a program from The Carnegie Foundation for the Advancement of Teaching, which teaches a combined statistics and developmental math class in a inquiry-based setting. Kevin is a contributing author, reviewer, and trainer for the Workshop Calculus and Workshop Statistics projects, funded by NSF. He has been in charge of the developmental math program, staffing the classes, running the Early Start summer program, and teaching a training course for the Masters students who teach the developmental classes.

Masters Students: Based on teacher evaluations, math knowledge, and general ability in the classroom, we chose Christopher Rozeville, Lindsay Wylie, Amanda Lien and Andria Barraza to help us on this project.

All four students share some commonality. They have all experienced teaching to a certain extent. Chris has the most experience, as a Credentialed single subject teacher, he has taught high school for seven years in urban areas with high needs populations. To survive this environment he has needed to be dynamic, able to adapt quickly to an ever-changing environment, learn how to deal with people from a wide variety of backgrounds, and output an incredible amount of work. Amanda had field placements in secondary schools near to Berkeley when she in their pure math program with a teaching concentration. She was afforded many opportunities to go to the board and explain math. Andria has taught summer students for struggling students at Stanford University. Lindsay worked at her local elementary school which she was at community college, serving as a math specialist and math tutor for struggling students. All four have now graduated and are teaching at community colleges.

Another commonality is that all four have struggled with math at one time or another. For Chris, he was bad at math as a child, but took this as a challenge and pushed himself. Amanda struggled in high school, repeating Algebra I and II twice. For her, it clicked in later, when the abstract was made more concrete by seeing applications to real life situations. Lindsay has dyslexia, a learning disability. To compensate, she has to work really, really hard. Understanding does not come natively.

Thus, without our prior knowledge, our fellow curriculum developers and teachers had experience with teaching, and experience with struggling in math, which helps them relate more to the population in developmental math.

Lecturers: Brandon Fitzgerald and Michaela Jesse are experts in the online program ALEKS. We use ALEKS for our online homework, but need it to be specifically tailored to our program, which requires expertise. ALEKS has a very steep learning curve, so it was very helpful to have their expertise.

#### THE DEVELOPMENT PHASE:

Collectively, the team developed a full twelve-quarter units' worth of curriculum from scratch (120 hours). Additionally, we created written homework, weekly checkpoints, and exams. Our team met weekly to go over drafts. This communication and multiple sets of eyes proved invaluable as we grappled with ongoing major decisions.

The ChaRM workbook tries to use student exploration to introduce every topic. For the instructors to resist the urge to lecture is difficult. As we created the curriculum we could envision how we would

teach the material. The big question came on every page, how to convey our thoughts to the future instructors? Thus, we inserted frequent “Note to Instructor” boxes, and we discussed how much or little had to be included in these notes.

Another major topic of discussion was determining the best way to introduce terminology and vocabulary in a coherent, natural way. We encourage students to be mathematicians and think like mathematicians, but this does not mean shoving down a litany of new mathematical terms with no context. So the team thought very carefully about how to unfold the topics in the correct order.

Overall, the mathematical and philosophical discussions from our weekly meetings proved invaluable in creating our material.

#### THE DELIVERY PHASE:

In Fall of 2014, a total of 269 students needed the three-quarter sequence of developmental math. We randomly assigned half of the population to ChaRM 805 and the other half to Math 800. We offered 7 sections of ChaRM 805 and 8 sections of 800 in the Fall. The passing 805 students then took 806 and 807 (the experimental group), while the passing 800 students then took 900 and 950 (the control group). If a student failed 800 in the Fall, then they didn’t repeat 800. Instead, we placed them in a section of 805 the following quarter. In Winter 2015, we offered 5 sections of 805 and 5 sections of 806. In Spring 2015, we offered 2 sections of 805, 5 sections of 806 and 3 sections of 807.

The ChaRM and 800/900/950 sequences were taught by both new and seasoned graduate TAs. To prepare the ChaRM TAs for this new teaching method, all ChaRM TAs attended a day-long orientation before the beginning of classes. The orientation included the flow of the course, explained in detail, the class culture building activities, use of the software ALEKS, the first week of math content to be covered.

To support the TAs during the Quarter, they signed up for a 1 unit course, Math 6005, which met for 70 minutes each week. In those weekly meetings, we discussed the mathematical concepts found in the subsequent week’s course material, what was successful the prior week and what needed improvement. We also addressed technical difficulties and class management issues.

#### RESULTS:

##### **A. Comparison of Pass Rates and Grades for “First-Time” Students**

The goals of this grant were two-fold: improve the pass rates of our students in developmental math and improve the inherent conceptual understanding of the material as reflected in a higher percentage of top grades. Thus, we wanted to investigate the following measures: (i) the pass rates in 805/806/807 and (ii) the percentage of students who earn an A or B.

We recognize the dangers of drawing strong conclusions when comparing student performance from year to year across a variety of class times and instructors. In the tables below, we will be comparing pass rates from ChaRM 806 to Math 900, and ChaRM 807 to Math 950. This is not quite a fair comparison as there is not a one-to-one correspondence in the curriculum and we compare academic year 2013-14 with 2014-15. However, because we were able to get access to longitudinal student performance, we are able to compare first time students versus those repeating the class for a second or third time. We want to compare populations as they move through the old 800-900-950 sequence versus the new ChaRM 805-806-807 sequence. Therefore, we only count students who enter CSEUB needing a full three quarter sequence of developmental math. We refer to these students as “pure,” meaning we ignored students who needed only one or two quarters of developmental math.

Below, are tables which compare statistics for first time students in ChaRM 805 versus 800, in ChaRM 806 versus 900, and in ChaRM 807 versus 950. We are interested in the grades and the pass rates. Generically, all three tables show the number of students from each section and the grade they received. We then aggregate the totals and compute the pass rates off of these aggregate numbers.

**TABLE 1**

<b>Comparison of Pure 800 with Pure 805 (first time students only) Fall 2014</b>							
<b>Section of 800</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	3	4	1	8	8	16	50.0%
2	1	3	7	3	11	14	78.6%
3	7	4	3	0	14	14	100.0%
4	2	1	3	6	6	12	50.0%
5	6	6	5	9	17	26	65.4%
6	1	6	16	0	23	23	100.0%
7	4	2	9	6	15	24	62.5%
8	1	3	1	0	5	5	100.0%
<b>TOTAL</b>	<b>25</b>	<b>29</b>	<b>45</b>	<b>32</b>	<b>99</b>	<b>134</b>	<b>73.9%</b>
<b>Section of ChaRM 805</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	9	3	0	6	12	18	66.7%
2	7	4	0	5	11	16	68.8%
3	4	4	0	9	8	17	47.1%
4	1	2	3	14	6	20	30.0%
5	11	2	0	9	13	22	59.1%
6	11	4	0	6	15	21	71.4%
7	12	4	0	5	16	21	76.2%
<b>TOTAL</b>	<b>55</b>	<b>23</b>	<b>3</b>	<b>54</b>	<b>81</b>	<b>135</b>	<b>60.0%</b>

In Fall of 2014, a total of 269 students needed the three-quarter sequence of developmental math. We randomly assigned half of the population to ChaRM 805 and the other half to Math 800.

In the aggregate, 74% of Math 800 students passed in the Fall, compared with only 60% who passed ChaRM 805. In retrospect, this makes some sense. We have always suspected that many students scrape by Math 800 without understanding the fundamentals. In fact, when comparing grades, 96% of those who passed ChaRM 805 received an A/B, whereas 55% received an A/B in Math 800. In addition, the pass rates from Winter quarter confirm our suspicion.

Due to our insistence on mastery of all topics, it is more difficult to pass ChaRM 805. In the conclusion of this report, we will address ways to increase the pass rate in ChaRM 805.

**TABLE 2**

<b>Comparison of Pure 900 with Pure 806 (first time students only) Winter 2015</b>							
<b>Section of 900</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	1	3	4	8	8	16	50.0%
2	1	0	0	1	1	2	50.0%
3	4	2	3	1	9	10	90.0%
4	0	3	4	11	7	18	38.9%
5	4	8	7	9	19	28	67.9%
6	1	3	2	3	6	9	66.7%
<b>TOTAL</b>	<b>11</b>	<b>19</b>	<b>20</b>	<b>33</b>	<b>50</b>	<b>83</b>	<b>60.2%</b>
<b>Section of ChaRM 806</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	6	3	0	3	9	12	75.0%
2	10	2	1	2	13	15	86.7%
3	7	1	0	7	8	15	53.3%
4	9	6	0	1	15	16	93.8%
5	11	0	0	5	11	16	68.8%
<b>TOTAL</b>	<b>43</b>	<b>12</b>	<b>1</b>	<b>18</b>	<b>56</b>	<b>74</b>	<b>75.7%</b>

In Table 2, we only consider those students who were successful in the Fall Quarter and taking either ChaRM 806 (from 805) or Math 900 (from 800).

In the aggregate, 60% of Math 900 students passed in the Winter, compared with 76% who passed ChaRM 806. The story behind these percentage is as follows: More students passed into Math 900, but fewer of them actually passed out of the course. The material becomes much more difficult. Because these students don't have the fundamentals, they have a very difficult time passing. When comparing grades, 98% of those who passed ChaRM 806 received an A/B, whereas 60% received an A/B in Math 900.

Both above observations support our hypothesis that the ChaRM methodology is increasing conceptual understanding. Also, the higher pass rate in Math 800 in Fall has a down side for students who continue on to Math 900.

**TABLE 3**

<b>Comparison of Pure 950 with Pure 807 (first time students only) Spring 2015</b>							
<b>Section of 950</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	0	3	1	0	4	4	100.0%
2	0	2	5	5	7	12	58.3%
3	0	2	1	1	3	4	75.0%
4	1	7	5	0	13	13	100.0%
5	5	3	1	1	9	10	90.0%
6	0	2	1	2	3	5	60.0%
<b>TOTAL</b>	<b>6</b>	<b>19</b>	<b>14</b>	<b>9</b>	<b>39</b>	<b>48</b>	<b>81.3%</b>
<b>Section of ChaRM 807</b>	<b># of A's</b>	<b># of B's</b>	<b># of C's</b>	<b>No Credit</b>	<b>Passing Students</b>	<b>Total Students</b>	<b>Pass Rate</b>
1	0	6	6	7	12	19	63.2%
2	13	3	0	4	16	20	80.0%
3	8	1	1	7	10	17	58.8%
<b>TOTAL</b>	<b>21</b>	<b>10</b>	<b>7</b>	<b>18</b>	<b>38</b>	<b>56</b>	<b>67.9%</b>

In Table 3, we only consider those students who were successful in the Winter Quarter and taking either ChaRM 807 (from 806) or Math 950 (from 900).

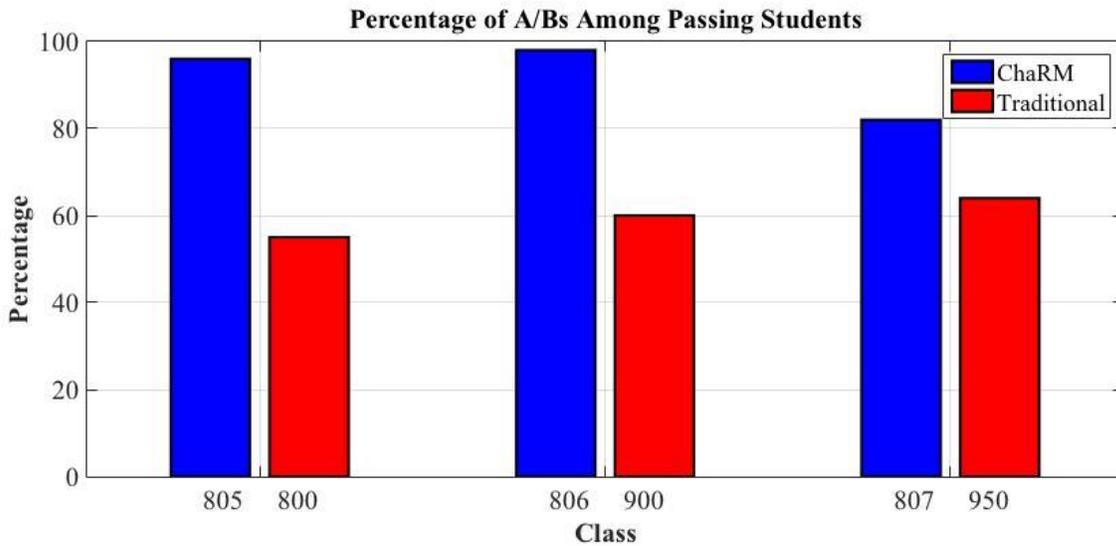
In the aggregate, 81% (39 students) of Math 950 students passed in the Spring, compared with 68% (38 students) who passed ChaRM 807.

When comparing grades, 82% of those who passed ChaRM 807 received an A/B, whereas 64% received an A/B in Math 950.

Both above observations support our hypothesis that the ChaRM methodology is increasing conceptual understanding. Also, the higher pass rate in Math 800 has a down side for students who continue on to Math 900.

Because of the mastery requirement, a student has to master all of the topics in the course, including say, word problems. In the traditional course, the only requirement is that a student's overall course average is 70%. Thus, for example, we regularly see that many students in 950 leave the word problems totally blank on their exams and are still able to pass Math 950, because their overall average is above 70%. However, in Math 807, we require mastery of all of the topics. The full range of skills developed in the developmental math program is in line with Institutional Learning Outcome #1: *Think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and every day problems.* Thus, we believe that the mastery approach serves the students and the University's goals. An overview of the high percentage of A/Bs for passing students is shown in the figure below. This data is found above in Tables 1, 2 and 3.

**Figure 1**



**B. Comparison of Pass Rates for “Repeat” Students**

We are also interested in looking at people who were not always successful on their first attempt within a course. We label “repeat students” as anyone who had to take a course more than once.

In counting those students who were always successful, by Spring 2015, 39 of 134 students who started in Math 800 successfully completed their developmental math requirement. Of those who started in ChaRM 805 in Fall 2014, 38 of the original 135 students were successful in three quarters. Thus the same number of students in the ChaRM model and traditional model completed remediation in three quarters.

However let’s dig deeper into the story and see what happens to the repeat students.

We investigated what happened to students who had to repeat the first or second course in the three course sequence. What we noticed is that we had a higher pass rate for repeaters in our ChaRM courses. As you can see in Tables 4 and 5 below, we give the numbers and pass rates for those taking a course the second time.

**TABLE 4**

Description	Pass Math 800 2 <sup>nd</sup> time (Winter 2014 <sup>1</sup> )	Pass ChaRM 805 2 <sup>nd</sup> time (Winter 2015)
Number	19 out of 48	25 out of 47
Percent	40%	53%
Combined Pass Rate	86% passed Math 800 in either 1 or 2 quarters (2013-14 year)	79% passed ChaRM 805 in either 1 or 2 quarters (2014-15 year)

<sup>1</sup> In comparing the traditional and ChaRM models for the first course, we need to look at the 2013-14 academic year for statistics on the traditional model. This is because, in the 2014-15 academic year, those who failed Math 800 in Fall 2014 were moved into ChaRM 805 in Winter 2015. At this point, Math 800 ceased to exist.

**TABLE 5**

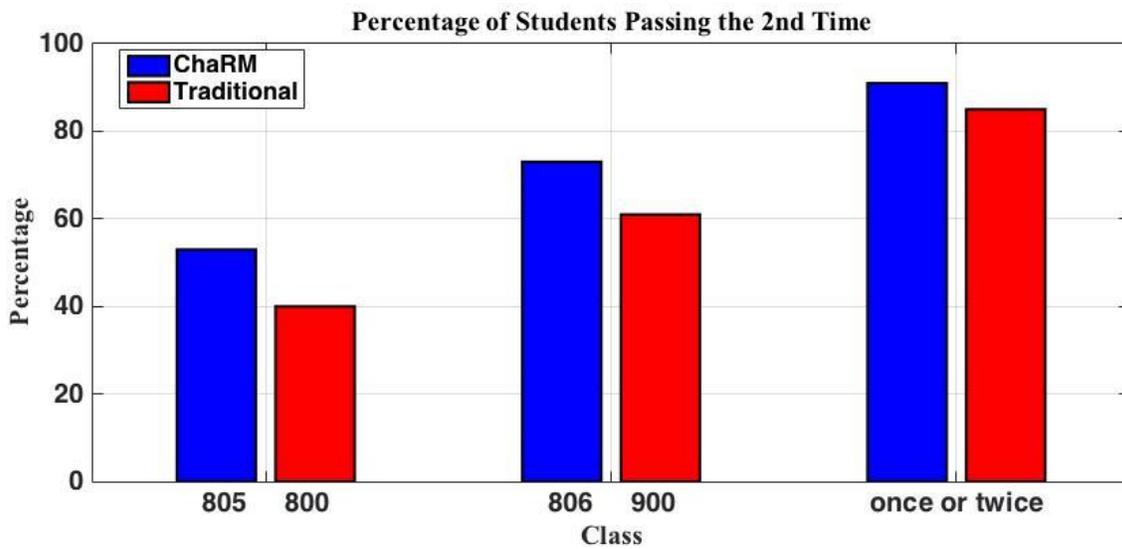
Description	Pass Math 900 2 <sup>nd</sup> time (Spring 2015) <sup>1</sup>	Pass ChaRM 806 2 <sup>nd</sup> time (Spring 2015)
Number	20 out of 33	11 out of 15
Percent	61%	73%
Combined Pass Rate	84% passed Math 900 in either 1 or 2 quarters (2014-15 year)	91% passed ChaRM 806 in either 1 or 2 quarters (2014-15 year)

<sup>1</sup> In the first column, these students took Math 800 in F14, then 900 in W15 and repeated 900 in Spring 2015. The table contains data on their performance in Math 900. In the second column, these students took Math 805 in F14, then 806 in W15 and repeated 806 in Spring 2015. The table contains data on their performance in ChaRM 806.

This reinforces our story that if you make it into ChaRM 806, you are ready to be there. A full 91% successfully complete the course in one or two quarters, versus 84% in Math 900

An overview of the percentages given in Tables 4 and 5 are show in the figure below. In particular, we show a side-by-side comparison for the pass rates for the second time through for the first two classes.

**Figure 2**



## CONCLUSION:

We had three major hypotheses for the ChaRM sequence.

Hypothesis 1. Due to our high standards, we anticipated that the pass rate for ChaRM 805 would be lower than that of Math 800. In the past, we saw that students were scraping by with a score of 70% in Math 800, moving on to Math 900, without really having the necessary skills to succeed in Math 900. We wanted to break this cycle by only allowing students to move on when they are truly ready.

Hypothesis 2. Those who make it to ChaRM 806, belong there and are more likely to succeed in ChaRM 806 and ChaRM 807, as compared to those who are in the Math 900/950 sequence.

Hypothesis 3. Of those who pass any ChaRM course, there will be a higher proportion of A's and B's than the comparable Math 800/900/950 group of students.

Observations relevant to hypothesis 1:

- *Data* – Math 800 did have a higher pass rate than ChaRM 805 (Table 1), but those who repeated ChaRM 805 were more likely to pass the second time through than their 800 counterparts (Table 4).
- *Interpretation* – We expected so much more of the ChaRM 805 students than is usually expected of Math 800 students. The students had to master all material at a level of 85% in order to pass the course. Thus it was harder to pass the class.

Observations relevant to hypothesis 2:

- *Data* – As expected, the pass rate for ChaRM 806 was much higher than Math 900 (Table 2). However, the pass rate for ChaRM 807 was less than Math 950 (Table 3).
- *Data* – A large percentage of students (91%) passed ChaRM 806 in one or two quarters (Table 5).
- *Interpretation* – If a student made it into ChaRM 806, then they were ready to be there. Their knowledge of the mathematical fundamentals was stronger than those entering Math 900.
- *Interpretation* – However, the comparative pass rate dropped in 807 versus 950. We believe that this is due to the fact that ChaRM 807 had a full six units, which was just too much material. Because ChaRM 806 has four units, we are moving some material from 807 to 806. We anticipate that this will help improve the 807 pass rate.

Observations relevant to hypothesis 3:

- *Data* – In all three ChaRM classes, the percentage of A/Bs are significantly higher than the comparable 800/900/950 courses (Figure 1).
- *Interpretation* – We required mastery in order to pass the course and thus the passing students really needed to know all of the material, resulting in high grades.

## NEXT STEPS:

1. We feel that the ChaRM program is well worth continuing, however we have learned some valuable lessons from this year's roll out and seek ways to improve the program. One of the key elements is the balance between mastery and student success. How high do we need to set the bar so that students will succeed in later courses? This past year, we set that at 85%. This coming year, we are setting this threshold to 80%. We believe that this will still maintain the "culture of mastery" which we have sought to create.

2. In the big picture, it isn't just about success in individual courses, but overall student success in their quantitative reasoning courses at CSUEB. In subsequent years, we will be conducting a longitudinal study of student success.
3. After teaching the full sequence for the first time this past year, we see the necessity of rearranging the arbitrary break points between courses. It is possible that a reason for the poorer pass rate in ChaRM 807 could be due to the extensive amount of material to cover. Thus, we are moving one of the units from 807 back to 806 to alleviate the time crunch.
4. Our method for covering the syllabus was to give the students a "syllabus quiz." The purpose was for students to answer particular questions by seeking out the answers in the syllabus, thus familiarizing themselves with the syllabus rather than the instructor lecturing on it. Due to its success, this approach will be used in *all* developmental math courses starting in Fall 2015.
5. We are spending this Summer fine tuning the workbooks, exams, homework assignments, and ALEKS software. In particular, we will be adding to our test-bank. The Math Department will annually update both the test-bank and perform necessary updates to the other course material.
6. We have collected a vast array of qualitative data, both from instructors and students, which needs to be analyzed. From the students, we have pre and post-attitudinal surveys, copies of first pages of all exams in order to study student mathematical explanation skills, and informal in-class feedback. From the instructors, we have surveys from the mid and end-course regarding teaching the course and peer-to-peer observations. This will take years to analyze.
7. Certainly the issue of students not passing developmental math classes is as much about culture as content. In particular, how connected a student feels to peers, to instructors and to the University can directly impact their academic success. We hope to investigate ways to strengthen this connection.