



**Student Success  
Initiative**

## **Final Project Report**

# **Streamlining the First Year: Developmental Math Reform**

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## **Project Description**

The project has multiple aspects, all with the goals of improving student success rates, preparing students for their subsequent courses, and reducing the number of semesters spent in non-credit bearing courses. The first facet of this project was to add a credit bearing College Algebra course (Math 110), allowing many students who previously would have begun in the non-credit bearing Math 090, Intermediate Algebra, the chance to start in a credit bearing course. This also allowed a reworking of the topics covered in Math 090, as well as the course that follows Math 110, Precalculus (Math 121). Another aspect was adding corequisite courses alongside Math 090 and the credit bearing Math 118 (Mathematical Reasoning), allowing students that place into a Beginning Algebra level to begin in Math 090 or Math 118 by also taking a corequisite course, potentially reducing the number of semesters in a non-credit bearing course.

## **Scope**

The College Algebra course (Math 110) was successfully added, and its first semester was Fall 2016, with four sections, having a cap of 140 per section. The course has a lecture component, as well as a discussion component. The course was designed to provide enough emphasis on exponential and logarithmic functions, as well as a brief introduction to trigonometric functions to be the prerequisite for Calculus for Life Sciences (Math 170). Previously, students were required to take precalculus before taking Math 170.

The addition of Math 110 allowed for more flexibility in Precalculus (Math 121). As a result, in Spring 2017, the schedule for Precalculus was adjusted. Beginning material was removed, but highlighted throughout the semester, and additional time, working with vectors, was added. Intermediate Algebra (Math 090) was also redesigned to cover less material. The removed material is now the beginning material for Math 110. Math 090 previously covered far too much material, not allowing the time needed for most students to comprehend and apply the material, as well as retaining the material. This was evident not only in DFW rates, but also when looking at Math 090 student's success rates in their subsequent courses, when compared to those that place into those courses.

The corequisite course (Math 088) for Intermediate Algebra was successfully added and began Fall 2016 with 8 sections, capped at 20 per section. Teaching Assistants taught these courses that met twice a week for 50 minutes. Also, a pilot of the corequisite course for Mathematical Reasoning (Math 118) began Fall 2016, with one section offered. This pilot was taught by the instructor for Math 118, and it met twice a week. Math 075 was used as the corequisite for Math 118 in this pilot. In Fall 2017, Math 075 will no longer be offered, and the official corequisite for Math 118, which will be Math 077, will begin.

Math 118 was also redesigned in Fall 2016 to be more project based with applications. Specifically, including material on linear regression and modeling, interest and applications, geometry and measurement, probability, statistics and distribution. Students are required to complete a final project.

## **Project Outcomes and Impact on Student Success**

### **Addition of College Algebra**

- Over half of the students that previously would have been placed into Math 090, a non-credit bearing course, were placed into Math 110, a credit bearing course. A total of 413 students in Fall 2016 took Math 110, instead of taking a non-credit bearing course.
- 310 of the 413, about 75%, passed Math 110 with grades of A, B, or C.
- Specifically, 23.7% received A's, 25.7% received B's, 25.7% received C's, 7.7% received D's, 9.9% received F's, 0.5% received an Incomplete, and 6.8% received W's.

Having over 300 students take and pass a credit bearing Math course their first semester, rather than a non-credit bearing course, has a large impact on student success, as well as meets one of the goals of the project, to limit the number of semesters spent in non-credit bearing courses.

To see how this affects success in subsequent courses, Spring 2017's first exam results were analyzed in Precalculus (Math 121), the course that the majority of Math 110 students take next. Here is a breakdown of the first exam results for Math 121:

- 311 students took the first exam in Math 121 Spring 2017. Of those 161 took and passed Math 110. The other 150 students did not previously take Math 110.
- For the Non-Math 110 students, 67.33% passed the first exam in Math 121, with 16% A's, 22% B's, and 29.33% B's. Also, 8 Non-Math 110 students did not take the first exam.
- For the Math 110 students, 91% passed the first exam in Math 121, with 35% A's, 37% B's, and 19% C's. Only one Math 110 student did not take the first exam.

Of course, this is only considering the first exam of the course, but the results are encouraging that Math 110 potentially prepares students well for their subsequent courses, providing a strong base to build on.

### **Addition of Math 088**

- Math 090 had 318 of its 498 students pass, about 64%, which is similar to previous semesters.
- Per section pass rates in Math 090 varied from 55% to 75%.
- Math 088 had 91 of its 111 students pass Math 088, about 82%.
- 107 of the 111 Math 088 students also took Math 090. Of those, 55 also passed Math 090, about 51.4%.
- The pass rates for Math 088 students varied drastically, based on the Math 090 instructor, ranging from 29% to 89%.
- The pass rates for Math 088 students did not have as much dependence on the Math 088 instructor.

**Comparing Math 088 students' Math 090 pass rates based on Math 088 instructor:** There were three Math 088 instructors, and 8 sections of Math 088. Section size varied between 7 to 20 students per section. Per instructor, the Math 088 pass rates in Math 090 were 47% (average of 15.7 students per section), 48% (average of 15 students per section), and 62% (average of 9.7 students per section). The instructor with the highest pass rates had the fewest students, and a significantly lower number per section. This seems to support the idea of smaller 088 sections, and/or an addition of a peer mentor tutor, PMT, in each section. In addition, in interviews throughout the semester, the two Math 088 instructors with the lower pass rates expressed that they felt the majority of their 088 students needed the extra support 088 was giving them, and perhaps more support from PMTs. Both said they would be very excited and felt the need for PMTs in their class. From the beginning of the semester, the third instructor with low enrollments and high pass rates expressed that he felt many of his students did not need 088. He mentioned that he wasn't sure why they did not score well on the placement. He also mentioned that those students helped others in his class.

**Comparing Math 088 students' Math 090 pass rates based on Math 090 instructor:** There were four sections of Math 090, (sizes: 132, 131, 130, and 105). As mentioned above the pass rates in each section did vary quite a bit. A table below shows a break down for each section of their total number of students, number of 088 students, overall pass rate, pass rate of those taking only 090 (excluding 088 students), and finally the pass rates of the 088 students.

Section	Total # of students	# and % of 088 students	Overall pass rate	Pass rate for 090 only students	Pass rate for 088 students
A	132	21 15.9%	63.6%	64.9%	57.14%
B	130	28 21.5%	74.6%	71.3%	89.29%
C	105	28 26.7%	55.2%	64.9%	28.57%
D	131	30 22.9%	60.3%	68.3%	33.33%

This shows a striking difference between pass rates for Math 088 students based on the Math 090 instructor. Note the overall pass rates per section varied quite a bit, but when excluding the Math 088 students, the Math 090 pass rates per section were not as varied. When looking at the pass rates for 088 students in 090 per section, these varied greatly, ranging from about 29% to over 89% per section. This supports research from other institutions, showing that pass rates for students taking co-requisite courses vary greatly depending on the instructor, as well as that those in co-requisites can actually pass at a higher rate than those not in co-requisites, likely due to the additional support.

In interviews done with instructors throughout the semester, the three sections with the lowest pass rates all reported no difference in their pace of the course (in comparison to previous semesters, although one instructor had only been a TA in previous semesters), as well as lecture being the primary type of instruction. For the section with the highest 088 pass rate, the instructor reported concern, due to having to significantly slowed the pace of each class down. Specifically, they said they typically did about half to two-thirds the number of examples in class compared to

previous semesters. However, it should be noted that all sections covered the same material, in the same depth, had common homework, discussion sheets, and all took the same exams (midterms and final). This instructor's primary mode of instruction is active learning, meaning the use of in class worksheets, with students' participation.

Having the high pass rate for Math 088 students in Math 090 for one section, and using that as a model is an encouragement that the corequisite model can be a success.

### **Math 118, Mathematical Reasoning and its Corequisite Course**

- 145 of the 176 Math 118 students passed, about 82%. Comparing this to pass rates from Fall 14 (61%) and Fall 15 (70%), shows a great improvement.
- 28 students took Math 075, and 10 of those also took Math 118.
- 20 of the 28 passed Math 075, about 71.43%. 8 of the 10 also taking Math 118 passed Math 075, 80%.
- Of the 10 students in Math 075 who also took Math 118, 6 passed (A, B, or C) Math 118. There was 1 D, 1 F, and 2 W's, and the 2 W's also withdrew from Math 075.
- Math 075 is currently an 8 week course, so the students taking both Math 075 and Math 118 only had the corequisite for the first half of the semester.
- Math 077, beginning in Fall 2017, and replacing Math 075, will be a full semester course.
- In Fall 2015, there were 241 Math 075 students. This coincides with the students that took Math 075 + Math 088 in Fall 2016. Note that there were 139 students in this group. So Fall 2016 saw a drastic decrease in the number of students taking these courses. This could be due to new changes in our placement exam, making retakes more accessible.
- 61 of these 139 students passed either a credit bearing course (the 6 in Math 118) or they passed Math 090, which saved an additional semester in a non-credit bearing course. Those that didn't pass Math 090 or Math 118 did not necessarily add additional semesters in non-credit bearing courses, since they would have spent that semester in Math 075 in the past.

### **Changes for Spring 2017**

- In looking at the current pass rates for the credit bearing courses of Math 110 – Math 210, they are consistently at or above 70% since Fall of 2015, with one exception. Comparing this to the lower pass rate of Math 090, we have implemented a new attendance policy in Math 090 to match that of Math 110 – 210 this Spring 2017. Previously, Math 090 did not have an attendance policy, and lecture quizzes were used to encourage attendance. However, likely since this is a Satisfactory/Unsatisfactory graded course, this did not result in high attendance rates.
- The instructors for Math 090 and Math 110 have agreed to use worksheets in lecture, doing active learning.
- Peer Mentor Tutors have been added to Math 088. The PMTs attend class and hold extra office hours outside of class.

### **Project Sustainability**

MSCS hired a Director of Precalculus in Fall 2015 to implement these changes, and we believe this increases its sustainability. In addition, Math 110, Math 088, and Math 077, as well as affected

existing courses, Math 090, Math 121, and Math 118, have a coordinator to oversee these changes. Regular meetings and correspondence between the director and coordinators improve consistency. Each course and the changes are evaluated several times throughout the semester to bring ideas for improvement and sustainability. Regular discussions throughout the semester also are held with instructors and TAs to promote excellence in teaching, as well as provide resources.

MSCS has also hired a new director of the Math Learning Center. This director will work with the Calculus and Precalculus directors to provide training for the Peer Mentor tutors used in the corequisite courses.

Math 090, Math 110, Math 118, and Math 121 are all taught in large lectures, which leads to a need for relatively few instructors. The addition of Math 110 simply shifted students that would have taken Math 090, so this does not require a large addition of instructors or teaching assistants. Also, Math 075 was previously taught by an instructor, and Math 077 will likely be taught by a teaching assistant in the future, which could reduce cost. Math 088 is the one course that directly requires additional staffing. It is being taught by teaching assistants, which potentially allows the department to provide more teaching assistant positions. However, with the increase in pass rates recently, the enrollments in later courses have declined slightly, requiring fewer teaching assistants in those courses, so it is possible this will even out in the long run.

## **Assessment Plan**

As described in the previous section, directors and coordinators have been assigned to oversee these changes, and assess them consistently. Regular meetings will continue to be held. Each semester, instructors and TAs will meet to discuss their techniques. Data will be collected and evaluated, looking not only at each course, but also evaluating student success in subsequent courses, as well as comparative analysis to hopefully highlight best practices. The director will write reports and distribute those to the Head of MSCS, instructors, and coordinators, asking for feedback and ideas for future semesters. A teaching assistant is currently working with the director to analyze data throughout the semester.

## **Lessons Learned**

Regular evaluation of data collected, like grades, section enrollments, surveys and/or in person discussions with instructors, teaching assistants, and students are essential not only to the success of a project, but in consistently improving and growing the project.

## **Project Deliverables and Documentation**

- Periodic Status reports
- Syllabus and curricular material for all courses involved.
- Survey of Math 088 students
- Interviews with Math 088, Math 090 and Math 110 instructors
- Report detailing the results of the implementation of Fall 16

- Course Request System's Add Request for Math 110, 088, as well as change requests for Math 090, 121, and 118 (content changes and reducing from 5 to 4 credit hours).
- Program Request form, requesting Math 118 be moved to Quantitative Reasoning status
- Grade distribution comparisons for Math 121 Fall 14, and Math 165 Fall 14 and Spring 15, displaying the differences in performance for students that placed into the course or transferred in compared to students that first took Math 090
- Notes and replies sent to departments that previously used Math 090 as a prerequisite for one of their courses, informing them of our changes, asking for feedback, and suggesting they look over the new content to assess if Math 090 was still the proper prerequisite.
- Project Management Plan
- Final Project Report