Creating an Efficient Remedial Mathematics Program

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Remedial Mathematics

Background

Mathematical remediation is an issue that all modern post-secondary institutions deal with; it is not isolated to Texas or Southwestern, or to most pre-1980 universities. Numerous studies point to minimal student participation in SEM (Science, Engineering, and Mathematics) areas. Instead, students are pursuing the softer degrees with the belief that a diploma itself is an entry ticket to the job market. However, lack of interest in mathematics results in lower levels of college preparedness and hence lower levels of college success.

Quantitative literacy (QL), or the lack thereof, plays a specific role in academic success and a general role in career and life success. For instance, high school students completing Algebra II are twice as likely to graduate from college. Career wise, the most employable people and the list of "best" careers (as measured by stress level, income, and working environment), put out by several entities such as U.S. World report, are all SEM in nature.

Approximately 60% of all college students enter remediation and 67% of these never finish. This amounts to 2 in 5 of ALL University students dropping out due to lack of QL. Retention rates for first-time College freshmen are 4th, 5th, 8th, and 13th lowest out of 50 states for Louisiana, Oklahoma, Arkansas, and Texas respectively. These states make up the majority of the nearest customers for Southwestern. Other studies reveal that on a national level only 32% of college students are deemed ready for college level mathematics. Southwestern's 2011 incoming class matched this statistic with just 31% of freshmen being placed into college algebra.

Student satisfaction is paramount in maintaining retention levels. The current placement procedure at Southwestern is inaccurate and remediation is possibly being over administered. As a result, remedial mathematics is a large part of student dissatisfaction and, therefore, student

attrition. The present method is to place students by SAT score, those below 500 going through remediation. Remedial classes meet 5 days a week and are non-credit bearing. Failure to complete remediation and MATH 110 in a timely manner disallows students from registering for 300 and above level courses. Inability to pass the remedial courses results in students being asked to complete their education elsewhere (if they finish at all). In effect, the student has 3 semesters to complete two remedial courses before they can begin a genuine college-level course (see the attached flowchart).

MATH 110, College Algebra (and MATH 241 in special circumstances), is the first college-level course that students can take after completing remediation in order to meet their general education requirement. Only after MATH 110 is complete can a student attempt other math classes that may be part of their degree plan. This remedial procedure results in 3 to 4 semesters before a student is allowed to attempt math classes, beyond Math 110, required by their degree plan.

Effective programs might appear initially to cost more than ineffective ones, but the benefits of success – in reduced repetition of courses, and in improved retention and graduation rates, and in increased opportunities for students – far out-weight the visible costs of these programs. In fact, effective programs can actually be less expensive overall and the poorly prepared student will succeed with effective programs regardless of cost. A revitalized remedial mathematics program will meet the needs of the current student body.

What can Southwestern's math program look like in order to be more efficient and cost effective? There are several issues to consider when designing a remedial mathematics program. 1. Mathematics placement is notoriously inaccurate.

Southwestern currently places students by their SAT score. Though this is very efficient it is about as accurate as choosing students for a spelling bee according to their shoe size. Shoe size works because older children tend to have larger feet than younger children and older students tend to spell better. Similarly, mathematics placement is a double-edged sword; efficient placement methods are inaccurate while accurate methods are inefficient.

One possible middle-ground solution to this dilemma is to farm-out the placement work to companies such as AccuPlacer, ALEKS, or MapleTA. At this point in time I would recommend MapleTA. With this product students need a URL and a personal password provided by MapleTA. The MapleTA website supplies a placement exam that can be taken anywhere, anytime, is reliable, and is instantly reported to Southwestern. It will require a certain level of trust as the test is taken under a proctor.

2. The Remedial progression path is too long.

Solution: reduce remediation to one class. A single class is appropriate for the majority of Southwestern's students. The curriculum of pre-algebra and college algebra need to be revisited in order to align topics efficiently. Once topics are chosen and aligned, pre-algebra and college algebra must be taken consecutively.

A small number of students may not be up to the level of the one remedial class offered. These students will work with tutors, at their own pace, on computer programs such as ALEKS. This student-paced software shows students exactly where they are weak and allows them to progress at their own pace. These lower-than-remedial students would be under the same 3-semester cap as other students. It is also advisable that these students pay for the extra tutoring required. They may be eligible for a dispensation as determined by Testing & Counseling.

3. The majority of incoming students do not appear ready for college-level mathematics.

Post-secondary schools nationwide are being inundated with supposedly ill-prepared students, deemed as such by the institution they choose to attend. Without lowering standards or expectations, professors must repeat the mantra, "teach who you have, not who you think you should have". Mathematics department priorities must match the actual student population. For instance, lecture is effective for students who arrive with high levels of motivation and persistence. However, the uninterested student needs to be more active and have varied modes of instruction.

The Mathematics Department needs to offer appropriate and appealing courses that meet the needs of all students who enroll at Southwestern. The department needs to answer the question, "What is math being taught for?" The answer, for first time freshmen, is given in specific by the serviced departments and more generally by saying students are taught responsibility, time management, quantitative literacy, and the love of learning. Students are not being taught mere symbol manipulation, formula memorization, non-contextual shortcuts, and the feeling of being with a babysitter. Professors must consider the general mathematics class taught to be the last math class the student will ever take and leave the student with positive feelings.

4. Placement methods do not seem to be working optimally.

An unknown number of students are typically misplaced in the placement process. This is more apt to happen in a placement system that considers a single number that imprecisely relates to mathematical ability such as the SAT. The ACT is only slightly better than the SAT. Furthermore, the current ACT cut-off of 21 is a very stiff requirement (~60th percentile).

Students should have the opportunity to practice and know what they are going to be tested on. Placement tests should not be a surprise for the student. A placement exam needs to be

given along with a practice exam well before registration time. Practice exams should be available during the student's high school senior year and/or summer before application. A challenge test should be made available for placement decisions that are not agreed with.

5. Remedial courses are typically taught by adjunct faculty.

The elementary courses need the most creative energy. Courses staffed on the cheap result in students repeating courses, failing related science courses, or dropping out of college altogether. Students who succeed in their first college mathematics course are far more likely to succeed in college than those who do not. Cheap courses are not necessarily as cost-effective as they appear.

Many students entering remedial mathematics do not understand it and believe algebra is merely symbol manipulation and formula memorization. Once this thought is internalized, the student's goals of higher education and a better life are lost. Human thought is intertwined with symbols and the alphabet. The ability to make representations with symbols is the actual precursor to thought. Algebra must be learned as a tool for reasoning and not as an end in itself. Learning is the result of thinking, which is the result of studying, which is the result of motivation (intrinsic more than extrinsic). In other words, curiosity and passion trump pure intellect. Successful understanding requires teachers that inspire.

6. The mathematics department exercises disproportionate influence over the institutions graduation rate.

Students need to meet with success their first semester in college. A small increase in the percentage of students who complete mathematics courses with a well-earned sense of accomplishment can translate into higher graduation rates in many disciplines that depend on mathematics. Conversely, any decline in the success rate in first-level mathematics courses

cascades into even higher drop-out rates by students who find themselves lacking prerequisites for key courses in their majors.

7. A successful mathematics department MUST have the proper resources to achieve objectives.

Mathematics cannot be taught successfully without resources adequate to the task. One must commit resources to promising new approaches in which the cost of success compares favorably with the cost of failure. Included in resources is enough man-power to teach a variety of courses. Strong math departments replace/change half their courses once every ten years.

Executive Summary

•Reduce the remedial program to one course.

•Create 3 levels of achievement: Pre-Algebra (remedial), Algebra, and Pre-calculus (Statistics).

•Students are placed by their ability as determined by an outside source (MapleTA).

•Placement will arrive at Southwestern with the student's application papers.

•Completion of the remedial course puts students on Algebra level.

•Pre-algebra and college algebra must be taken consecutively.

•Remedial classes meet 3 days a week with a lab.

•Require advisors to follow placement advice.

•Assign a specific person the job of policing placement policy! Better yet, use registration holds.

In rare occasion there may be students who place below pre-algebra or above pre-calculus. The small number of students found not ready for pre-algebra are in need of extra help and may eligible for government mandated assistance. Students placing this low are in need of a personal tutor and should be working at their own pace (ALEKS) with a 2 semester maximum. Each of these individuals would start at their own level. Hard workers go faster and misplaced

students can get on track more quickly. ALEKS tutors can be provided by the Mathematics department and/or from outside sources at the student's expense.

Mathematics Progression (2011/2012)

An SAT of 500 or an ACT of 21 along with appropriate high school courses and grades permits a student to register for either **MATH 110** or **MATH 241**.

All students with test scores below the minimum will be placed in MATH 011. The nominal expectation is that they will complete the mathematics remediation by the end of their first year (two semesters). Students **must** complete all remedial mathematics within three semesters. This permits them to complete the General Education mathematics requirement before the end of their sophomore year.

Mathematics Remediation Schedule

First Year 1st Semester		First year 2nd semester		Second Year 1st semester		Second year 2nd semester
MATH 011	A	MATH 110				
	B, C	MATH 012	A, B, C	MATH 110 or MATH 241		
			D	MATH 012	A, B, C	MATH 110
					D, F, W	Withdraw
			F, W	Withdraw *		
	D	MATH 011	A	MATH 110		
			B, C	MATH 012	A, B, C	MATH 110 or 241
					D, F, W	Withdraw
			D, F, W	Withdraw		
	F, W	Withdraw **				

*may appeal with justification to be permitted to retake **MATH 012** one more time only
** may appeal with justification to be permitted to retake **MATH 011** one more time only

"In progress" grades in **MATH 011** and **MATH 012** will be made available to advisors in time for pre-registration for the next semester.

Progression through the mathematics remedial courses will be monitored by and any appeals will be considered by the **Admissions Committee**.

If a remedial math course is needed, then:
• **MATH 110** with a grade of C- or higher is **required** before **MATH 121**.
•Either **MATH110** with a C- or higher or **MATH 012** with an A or higher is required for **MATH 241**.

Students may normally attempt **MATH 110** no more than **two** times (D, F, or W). By appeal to the Vice President for Academic Administration, a third attempt may be allowed. Students who earn a grade of F in **MATH 110** are normally expected to enroll in **MATH 012** if they have not previously taken the course – any exception is by appeal.

Math classes must be taken in succession after completion of remedial mathematics.
Any cases not covered above need to go through the mathematics department for recommendation to the Admissions Committee.

Proposed Mathematics Progression

The students placement score (MapleTA) of X will be considered.

Min-A $\leq X <$ B   →   below remediation

B $\leq X <$ C   →   pre-algebra, MATH 011(remedial class)

C $\leq X <$ D   →   College Algebra, MATH 110

D $\leq X <$ E   →   Pre-calculus, Math 121; or Statistics MATH 241

E $\leq X \leq$ F-MAX →   Calculus, MATH 181 or higher where prerequisites are met

ALEKS	Pre-Algebra	College Alg.	Pre-Calc/Stats	Calculus
A	B	C	D	E F

All students with test scores below pre-algebra will be placed in ALEKS personal tutoring. The nominal expectation is that they will complete mathematics remediation by the end of their first year (two semesters). Students **must** complete all remedial mathematics within three semesters. This permits them to complete the General Education mathematics requirement before the end of their sophomore year.

Proposed 2012 – 2013 Mathematics Progression

Remedial Student Progression Chart

First Year 1st Semester		First year 2nd semester		Second Year 1st semester		Second year 2nd semester
Pre-algebra MATH 013	A, B, C	College Alg. MATH 110	A, B, C	Statistics or Pre-Calculus *		
			D, F, W	College Alg. MATH 110	A, B, C	Stats or Pre-calc.*
					D, F, W	Withdraw
	D	Pre-algebra MATH 013	A, B, C	College Alg. MATH 110	A, B, C	Stats or Pre-calc.*
					D, F, W	Withdraw
			D, F, W	Withdraw		
	F, W	Withdraw ***				

*Statistics (MATH 241) and Pre-calculus (MATH 121) are only taken if required by degree.
may appeal with justification to be permitted to retake **MATH 013 one more time only
*** may appeal with justification to be permitted to retake **Pre-algebra** one more time only

•Completion of **MATH 013** essentially gives the student a placement score of X,
$C \leq X < D$ → College Algebra, **MATH 110.** Hence, if remedial math is needed, then **MATH 110** with a grade of C or higher is **required** before attempting **MATH 121** or **MATH 241**.

•"In progress" grades in **MATH 013** will be made available to advisors in time for pre-registration for the next semester.

•Progression through the mathematics remedial courses will be monitored by and any appeals will be considered by the **Admissions Committee**.

•Students may normally attempt **MATH 110** no more than **two** times (D, F, or W). By appeal to the Vice President for Academic Administration, a third attempt may be allowed. Students who earn a grade of F in **MATH 110** are normally expected to enroll in **Math 013** if they have not previously taken the course – any exception is by appeal.