Developmental Math Proposal 3/17/15

Authored by Dr. Brad Thiessen, Chair Mathematics and Statistics, Assessment Coordinator, in coordination with Dr. Sarah Vordtriede-Patton, Interim Dean College of Arts & Sciences

Summary: Based on 4 years of assessment data and similar results in national studies, we have compelling evidence that remedial/developmental mathematics programs do not help underprepared students succeed in MATH 171. In fact, evidence suggests underprepared students who take developmental mathematics (face-to-face MATH 095, online MATH 099, or online/self-paced summer program) actually perform worse in MATH 171 when compared to similarly-abled students who take MATH 171 without any prior developmental experience.

We propose to:
1. Eliminate the developmental mathematics prerequisite from MATH 131, MATH 171, MATH 210, and STBE 137.
a. Move the administration of our prerequisite skills quiz to the first day of class in MATH 171 to inform instructors of skills their students lack
b. Embed mini-reviews of these weak skills within the college-level quantitative courses
c. Continue assessing student readiness and success via ACT Math scores, prerequisite skills tests, and common exam scores

2. Continue using ACT Math scores to identify students at-risk of struggling in college-level math courses
a. Students with ACT Math scores of 21 or lower can be given the option to complete the summer ALEKS program at their own cost (~ $35)
(Note: only 40 of the over 200 students who completed ALEKS in Summer 2014 registered for Math 171 in Fall of 2014.)
b. In addition to contextual math skills instruction added to MATH 171, strongly encourage peer tutoring for these students

3. Continue investigating other options for improving student success in college-level math courses toward implementation AY 2016-17
a. Options include investigating lab components, supplemental instruction, recitation sessions, online review modules

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Proposal #1: Eliminate prerequisite for MATH 131

Rationale: Adding a prerequisite last year yielded no perceptible change in student achievement. The course is being redesigned for next year and will not require a prerequisite.

Potential outcomes:
• Student enrollment: Relatively few students can take MATH 131 as a terminal math course, so we do not anticipate any change in enrollment.

• Student achievement: Students who do not need mathematics for their major will not be forced to take an ineffective developmental math program. We anticipate no adverse effect on student achievement

• Impact on other programs: Humanities majors will be able to complete General Education quantitative requirements in a single semester. This could have a small positive effect on other programs.

• Staffing/Costs: Since no students are required to take this course, we can control staffing costs. We do not anticipate any change.

Proposed course description: **+MATH 131. Thinking Mathematically, 3 credits**
This course is a survey of topics in applied mathematics stressing the connections between contemporary mathematics and modern society. Topics include critical thinking, financial management, statistical reasoning, probability, math in politics, and math in art. This course meets the general education requirement in mathematics.
~~Prerequisite: MATH 099 or ACT Math score of at least 22~~

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Proposal #2: Eliminate prerequisite for MATH 171

Rationale: 4 years of assessment data strongly suggest our developmental math efforts are counterproductive. Students who completed our MATH 099 or summer developmental math program were 30% less likely to pass MATH 171 (compared to students with similar ability levels who did not complete developmental math at St. Ambrose). SAU data is virtually identical to the results of a ten year University of Virginia study of over 250,000 students. Our instructors are confident that elimination of the prerequisite will have no discernible impact on student achievement in the course.

While ACT Math scores, in combination with a prerequisite quiz we give during the first week of classes, have done a remarkable job of predicting student success in MATH 171, none of our developmental math programs (MATH 095, 096, 099, 101, summer ALEKS) have managed to improve student performance. Furthermore, we have not noticed any difference in student preparation or achievement due to the increases we made (prior to 2012-13) in math placement standards.

Potential outcomes:
• Student enrollment: Every St. Ambrose student will be eligible to enroll in a credit-bearing, college-level mathematics course in his or her first semester. This could, potentially, increase enrollment in the course, but we don't anticipate much of a change. We base this on the fact that our previous modifications to placement have had little change on enrollment:

Prior to 2012:
Placement – ACT Math of 12-17 = MATH 099; ACT Math of 18-22 = MATH 171
Sections offered: MATH 099 =4 ; MATH 151/152/171 = 15

2013-14:
Placement – ACT Math of 12-21 = MATH 099; ACT Math of 22-27 = MATH 171.
Sections offered: MATH 099 = 7; MATH 171 = 15
Impact of changes: Additional 3 sections of MATH 099 (which were ineffective)

2014-15:
Placement standards did not change, but ~180 students completed MATH 099 during the summer. This had the potential of increasing enrollment in MATH 171 by 100+ students.
Sections offered: MATH 099 = 6; MATH 171 = 15
Impact of changes: We actually offered 1 fewer section of MATH 099 this year. Of the ~180 students who completed the summer developmental program, only 40 went on to enroll in MATH 171 in the Fall. These students would have, in previous years, waited until Spring to take MATH 171. Based on this, we anticipate needing:
• 4 fewer sections of MATH 099 in the Fall; 2 fewer in the Spring
• 0-2 additional sections of MATH 171 (accounting for students who, in previous years, would have failed MATH 099 and never been eligible for MATH 171)

• Student achievement: As was stated earlier, 4 years of assessment data strongly suggests that our developmental math program was having a negative effect on student achievement in MATH 171. We anticipate no change in student preparation for, or achievement in, MATH 171. In fact, elimination of the prerequisite will allow us to focus departmental efforts and resources on students in MATH 171. We're currently investigating options for improving student success in MATH 171. The options we're investigating (but not proposing), include):

• Changing MATH 171 to a pass/fail course and fully implementing a standards-based grading scheme.
• Modifying the scope and sequence of course content
• Adding supplemental instruction, lab/recitation sessions, increased tutoring resources
• Increasing the course to 4-credit hours
• Learning communities or other ways to shape the course to specific majors
• Online course supplements

• Impact on other programs: Every St. Ambrose student will be eligible to enroll in a credit-bearing, college-level mathematics course in his or her first semester. This should benefit students majoring in credit-heavy programs. Because our developmental efforts were ineffective, faculty in other programs should not notice any reduction in the quantitative abilities of our students.

• Staffing/Costs: Eliminating the prerequisite will reduce our developmental math costs. Since we do not currently have any resources allocated for developmental math in 2015-16, the

proposal will not cause our costs to increase. Last year, we dedicated 0.75 FTE and 2 work study students to staff MATH 099, along with $7000 for the summer developmental program. There is no reason to spend these resources on a program that is ineffective. Eliminating the prerequisite for MATH 171 should make it possible for us to staff our General Education, service, and major courses with our current staffing levels.

Proposed course description: +MATH 171. Elementary Functions, 3 credits
Study of algebraic, exponential, logarithmic, and trigonometric functions; their graphs, properties, and applications. Graphing calculator strongly recommended.
~~**Prerequisite: MATH 099 or ACT Math score of at least 22**~~

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Proposal #3: Eliminate prerequisite for MATH 210

Rationale: The state requires Teacher Education candidates to have an above-average ACT score, so the prerequisite shouldn't impact many (if any) TEP majors. Also, since the prerequisite was not effective in improving student math ability, there's no reason to keep it.

Potential outcomes:
• Student enrollment and staffing costs: Since MATH 210 is a course for TEP students, the proposal shouldn't impact enrollment much at all.

Proposed course description: **+MATH 210. Theory of Arithmetic, 3 credits**
Limited to candidates for elementary teaching licensure or certificate. Topics include problem solving strategies, sets and elementary number theory and number systems, probability and statistics, informal geometry and measurement.
~~**Prerequisite: MATH 099 or ACT Math score of at least 22**~~

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Proposal #4: Eliminate prerequisite for STBE 137

Rationale: Since developmental math did not improve student preparation for college-level mathematics, there's no reason to keep the prerequisite for STBE 137.

Potential outcomes:
• Student enrollment: (obviously, I will need to check with the COB).

• Staffing/Costs: (obviously, I will need to check with the COB).

Proposed course description: **+STBE 137. Quantitative Reasoning in Business , 3 credits**
This course provides students the opportunity to develop quantitative insights and skills relevant to success in the study and practice of Accounting, Economics, Finance, General Business, International Management, Management and Marketing. Key topics include the role of functions, linear systems, optimization, and scenario analysis in business. Students will

develop skills in the visual display, written expression and oral presentation of analytic findings in a business setting.
~~**Prerequisite: MATH 099 or ACT Math score of at least 22**~~

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Effect of all proposals: Elimination of our developmental math program. We would still use ACT Math scores to predict student success (and, hopefully, target support in General Education courses), but we would not force students to complete ineffective developmental programs. This means we would not need to hire a full-time staff member to coordinate and teach developmental mathematics.

Notes:
We plan to take the proposal for prerequisite change (dropping Math 099 completely, and as a prerequisite for MATH 131/171/210 and STBE137; Brad is/will be contacting COB through Allison Ambrose, and Education through Tom Carpenter) to EPC in April, preferably April 14.

While we anticipate the bulk of the intensive support instruction to occur by Math 171 instructors in the courses themselves, discussion should take place regarding resource contingencies for the Student Success Center, should there be unintended, marked increase in student demand for Math 171 tutoring.

Attachments: (A relatively small sample of data we've analyzed)

2014-09-summer-results.pdf

Analysis of student performance in online summer program and prerequisite quiz during 2nd week of class in MATH 171.

Conclusion: Summer program improved student preparation by 1-2 questions on the prerequisite skills quiz. Still, these students who apparently mastered 100% of these topics during the summer retained very little of what they had "mastered." The overall average score was 60%.

2014-09-prerequisite-quiz.pdf

Another look at prerequisite quiz scores.

Conclusion: Summer program improved student preparation as measured by the prerequisite skills test, but it looks like skill retention is an issue.

2015-02-grades.pdf

A summary of assessment data shared with the Academic Affairs group.

Conclusion: We can predict student success in MATH 171, but our remediation efforts have been ineffective. Underprepared students who did NOT complete MATH 099 or ALEKS were 30% more likely to pass MATH 171.

Support for removal of MATH 210 prerequisite:

Begin forwarded message:
Date: March 25, 2015 at 3:27:06 PM CDT
Subject: Re: MATH 210 and our proposal to eliminate MATH 099
From: "Volkova, Tanya" <volkovatanyan@sau.edu>
To: Brad Thiessen <thiessenbradleya@sau.edu>
Cc: Thomas Carpenter <CarpenterThomas@sau.edu>, "Stoube, Deanna" <stoubedeannam@sau.edu>, "Degner, Katherine" <degnerkatherinem@sau.edu>

Brad,
That makes total sense to me!
When do you think it will come into effect - this coming Fall?
Tanya

Begin forwarded message:
Date: March 25, 2015 at 1:11:21 PM CDT
Subject: Re: MATH 210 and our proposal to eliminate MATH 099
From: "Carpenter, Thomas" <carpenterthomas@sau.edu>
To: Brad Thiessen <thiessenbradleya@sau.edu>
Cc: "Stoube, Deanna" <stoubedeannam@sau.edu>, "Degner, Katherine" <degnerkatherinem@sau.edu>, "Volkova, Tanya" <volkovatanyan@sau.edu>

Hi Brad - This looks really good to me.
Tom

Support for removal of STBE 137 prerequisite: