Sabbatical Mini-Report # 12
Connections – Science, High School and College

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Science

The traditional view seems to be that math has strong connections to the physical sciences, while the biological sciences have been seen as not mathematical.

Biology is an area of intense work in this period, both in research and in education. The research is very mathematical; see the Steen book for an analysis, and the MAA web site http://bioquest.org/esteem/ for examples. Some areas that cross biology with a social science … such as bioeconomics … are intensely mathematical (see the Clark reference).

The Romberg et al book provides a more general commentary on science and mathematics, though it is less specific about connections that exist.

A specific criticism is that introductory biology courses still tend to be qualitative, and do not reflect that mathematical nature of current work and applications of biology. In conversations with science faculty, another issue is the lack of information flowing both directions – both in terms of what mathematics preparation biology students have (after passing a MATH course) and in terms of what mathematical needs biology courses have that might impact the content of MATH courses.

In particular, much of the mathematical work in biology deals with exponential or logarithmic models. Students need to understand the graphs, identify the type of model, and use basic exponential models. Logarithms are frequently used to graph lab data in biology courses, even though the MATH courses taken by these students does not cover the topic.

Closer collaboration with science faculty is needed to better serve MATH students.

High Schools

The transition from high school to college is explored in the book by Kirst and Venezia; although not focusing on mathematics in any way, there are some good viewpoints represented.

I was able to visit 4 high school mathematics programs over the last year or so, including all 3 Lansing high schools and Holt High School. In all cases, competent teachers were dedicated to doing their best. However, it is clear that the playing field is not level – all Lansing high schools are working with old buildings and a lack of resources, while the suburban schools such as Holt are able to work in a modern building with more adequate resources. In addition, the Schools Of Choice option is sending large number of Lansing students to the suburbs … leaving a population with fewer resources to attend the city schools; the school district reports about 45% of their students are African American and I observed over 60% -- while the US Census shows about 21% of the city is African American.

The current curriculum varies between city and suburban schools, with the city schools using a more traditional curriculum and suburbs tending to use a curriculum closer to the NCTM standards. None of the classes observed were heavily using the graphing calculator, though some had classroom sets that were used on occasion. All of the schools will face the transition to the Michigan Merit Curriculum starting in 2007-08, which will directly impact the mathematical background of students coming to LCC … starting in 2008 and increasing thereafter.

Another dimension to the local high school scene is the HOPE Scholarship Program for the city schools. (See their website http://lansinghope.com/ for some details.) Sixth grade students are selected by their school (usually the principal) based on meeting any of a set of high-risk indicators. When a HOPE Scholar graduates, they attend LCC "free" – the HOPE Scholarship pays for any tuition, fees, and books not covered by their financial aid. The challenge is that the high-risk factors are correlated with not completing high school, as well as behavior issues in school. An LCC team is working with the Lansing School District to provide the best opportunity for the HOPE Scholars.

We continue to have a high need for communication and collaboration with area high schools.

College

Several colleges have implemented a mastery learning program; sometimes, this is limited to developmental mathematics (see Dorfman online and Marist online) …in other cases, the program includes precalculus and calculus (see University of Idaho online). Some implementations are entirely online.

A qualitative narration was found in an online article by Weinstein, "Their Side of the Story" … for developmental math students. In the college for the study, the

beginning algebra course was offered in a mastery learning environment (institution not identified).

An excellent source for connecting to other colleges is the Hastings book (MAA), which is a collection of short chapters written about specific practices at each author's college. The following data is from that book, in the chapter by McGowan; the college is Harper College, a large institution located in an affluent suburb of Chicago.

Harper College Mathematics Data: Percent of Students In Course (from a 2001 report)

Percent of course	Remedial	Precalc	Calc I	Other, with Coll Alg Prereq	Lib Arts/ Stats
ACT, SAT	3%	20%	24%	14%	26%
COMPASS	62%	26%	26%	26%	20%
Prior Course	35%	54%	50%	60%	54%

Note that 50% (or more) of students in transfer level courses come from the prior course.

Harper College Mathematics Data: Percent Success In Course (from a 2001 report)

Percent SUCCESS	Remedial	Precalc	Calc I	Other, with Coll Alg Prereq	Lib Arts/ Stats
ACT, SAT	56%	58%	66%	72%	68%
COMPASS	55%	54%	54%	63%	62%
Prior Course	42%	47%	46%	66%	62%

Note that the "prior course" group has lower pass rates in the first 3 columns.

Further, notice that the overall success rate for developmental courses is about 51%; in precalculus, the overall success rate is also about 51%. Our data at LCC, both overall pass rates and 'from prior course', compare very favorably.

Michigan State University

I was able to spend some time with instructors in the Mathematics Department at MSU; Jennifer Powers is a lead instructor for Mth 103 (College Algebra) … Michael Masterson is an instructor in the Charles Drew Science Enrichment Laboratory Program for Mathematics. From this contact, it seems likely that the faculty teaching "lower level mathematics" (especially intermediate algebra and college algebra) would be interested in ongoing contact and collaboration with our faculty.

The initial algebra courses at MSU are very low technology, whether taught in a large lecture hall or small classroom. The textbooks used are accessible in their

presentation and have many positive features, although they are quite traditional in content. (Mth103 uses Blitzer's College Algebra 3rd edition; web site http://wps.prenhall.com/esm_blitzer_coll_alg_3/0,7207,562624-,00.html; Mth1825 uses Tobey & Slater Intermediate Algebra 5th edition.) Student attendance is a faculty concern in both courses.

The Charles Drew Science Enrichment Laboratory is a long-standing effort by MSU to encourage minorities in science and provide support so that students complete their degree; see the brochure online http://drewlab.msu.edu/documents/drewbrochure.pdf . Transfer students are usually not involved, which means that LCC students are not in the program.

Kellogg Community College

I also spent time with instructors at Kellogg Community College in Battle Creek (Graham Smith and Brian Goetz). KCC offers a self-paced arithmetic class, then fixed-paced pre-algebra … beginning algebra … intermediate algebra and so on. In all courses beyond arithmetic, each KCC course covers more and more advanced material than the corresponding LCC class. For example, pre-algebra includes factoring the GCF from a trinomial … and intermediate algebra includes exponential & logarithmic equations & functions. No calculators are used in arithmetic; pre-algebra only uses a scientific calculator in the last unit, and beginning algebra does not require any calculator (graphers not allowed). College algebra is the first class to require a graphing calculator.

The KCC faculty are also seeing a need to communicate and collaborate with area K-12 teachers. Also, KCC is looking into the possibility of setting up a scholarship fund to pay for all developmental math courses for all students.

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