CURRICULAR CHANGE AND COLLABORATION ACROSS INSTITUTIONS

MichMAA/MichMATYC Spring Meeting

April 11, 2015

Jack Rotman (MichMATYC President 2013 – 2015)

For your consideration

- Collegiate mathematics in Michigan needs deliberate and organized state-wide leadership based in a diverse group of faculty working together, supported by both MichMAA and MichMATYC
- We'll use pre-calculus as our initial example

Path to Calculus I

- We all share a goal: Prepare students for Calculus I
- We do not share a model for implementing
- Out of 27 Michigan institutions (12 universities, 15 CC)

Coll Alg w/Trig (1 semester)	Coll Alg, Trig (2 semesters)	Pre-calculus (1 semester)	Pre-calculus (2 semesters)	Coll Alg, Pre-calculus (2 semesters)	Trig, Pre-calculus (2 semesters)
2	12 + 1	13	1	6	4

- Transfer: **18% of courses are NOT accepted as prerequisite to calculus I (average loss)**

  One semester pre-calculus has the least transfer loss.

Transfer data based on INCOMING information (receiving institution).

➔ Side note: Handout online

- Today's handout is on my blog, at **http://www.devmathrevival.net/?page_id=2144**
- The presentation slides will also be there

Checked	OK Transfer	Rate Transfer OK	Institution	Course Title
22	22	100.0%	Grand Rapids CC	Precalculus
21	21	100.0%	Henry Ford College	Precalculus
17	17	100.0%	Oakland University	Precalculus
19	19	100.0%	Washtenaw CC	Precalculus
20	19	95.0%	Western Michigan Univ	Precalculus Mathematics
19	18	94.7%	Monroe County CC	Precalculus
13	12	92.3%	Mott CC	Pre-Calculus
22	20	90.9%	Schoolcraft College	Precalculus With Trig
20	18	90.0%	Central Michigan Univer	Pre-Calculus Mathematics
19	17	89.5%	Macomb CC	Precalculus
18	16	88.9%	Kalamazoo Valley CC	Precalculus/Trig
17	15	88.2%	Univ Michigan - Dearbor	Pre-Calculus
23	20	87.0%	Michigan State University	Trigonometry
22	19	86.4%	Grand Valley State	Trigonometry
21	18	85.7%	Lansing CC	Accelerated Precalculus
7	6	85.7%	Montcalm CC	Precalculus
14	12	85.7%	Northern Michigan Univ	Precalculus
20	17	85.0%	St Clair County CC	Pre-Calculus
19	16	84.2%	Delta College	Pre-Caclulus
18	15	83.3%	Kellogg CC	Preparation for Calculus
18	15	83.3%	UM - Flint	Pre-calculus mathematics
23	19	82.6%	Oakland CC	Trigonometry
17	14	82.4%	Michigan Tech Univ	Precalculus
16	13	81.3%	Mott CC	Trigonometry
20	16	80.0%	Macomb CC	College Trigonometry
19	15	78.9%	Eastern Mich Univ	Plane Trigonometry
19	15	78.9%	Muskegon CC	Trigonometric Functions with Coord
19	15	78.9%	Oakland CC	College Algebra and Trig
25	19	76.0%	Jackson College	Pre-Calculus
16	12	75.0%	Montcalm CC	College Alg
15	11	73.3%	Eastern Mich Univ	Topics in Precalculus Mathematics
22	16	72.7%	Michigan State Universit	College Algebra and Trig
21	15	71.4%	Central Michigan Univer	College Algebra
21	15	71.4%	Ferris State Univ	Adv Algebra - Analytical Trig
21	13	61.9%	Lansing CC	Precalculus II
17	10	58.8%	Michigan Tech Univ	College Algebra II with Trig
17	10	58.8%	Monroe County CC	Trig & Analytical Geom
18	10	55.6%	Ferris State Univ	Algebra - Analytical Trig
16	7	43.8%	Saginaw Valley State Un	Intro Math Analysis

How Effective is Pre-Calculus ?

- Brief answer: **Not so much**
- Study by Sonnert and Sadler (n=10,500)

Average students	**No benefit from pre-calculus**
Below average students	Insufficient n value
Above average students	NEGATIVE benefit from pre-calculus

- These results are NOT SURPRISING … considering the history of our work (more later)

Conference Board (CBMS)

- Forum 5 (October, 2014) Topic: **Math in the first two years**
- Related to: **Mathematical Sciences in 2025**
- Undergraduate Mathematics – both STEM & non-STEM:
  - Conceptual foundations
  - Numeric methods & modeling
  - Balance with procedural fluency

College Algebra, the Artifact

- Pre-calculus is usually as a descendent of "college algebra"
- Original "College Algebra" (1888) [G Wentworth]
- Derived from general education mathematics at Harvard, Yale & Bowdoin

  Reference: Jeff Suzuki, talk on College Algebra

- Never designed to prepare students for calculus **(college algebra was 'instead of calculus')**

Could it be ??

- College algebra and pre-calculus course content is even more obsolete than the content of developmental math courses.

Saved by “Common Core”??

- Common Core math outcomes WERE based on ‘college ready’
- … and career ready
- Many meanings of “college ready math”
- Past experience indicates that results will be positive … and minor
- Zal Usiskan ‘cleaning up after Common Core’ [there is no infinity, etc]

Futility of Isolated Reform

- All levels of college mathematics may need basic reform
- Pre-calculus … Calculus
- Developmental
- Most reform efforts fail – not due to a lack of validity
- Developmental Mathematics reform HAS been successful (2010 ➔)

Lessons on Successful Reform

> 20,000 students currently in truly reformed Dev Math

- Professional organizations deeply involved (academic committee AND national officers)
- **Content created by faculty collaborating, using professional resources**
- Avoid focus on ONE ISSUE ('modeling' only)
- **Long-term conversations among faculty**
- **Multiple solutions (options for faculty)**
  Carnegie; Dana Center; AMATYC New Life
- **Did not depend upon "one good book"**

Transfer of Lessons to Pre-Calculus

- Many necessary conditions currently exist (such as professional resources about content)
- One solution being developed (Dana Center)
- MAA and AMATYC can partner at the national level
- A joint task force could support a Michigan reform (MichMAA and MichMATYC)

You May Already Know About…

- MAA project: “Characteristics of Successful Programs in College Calculus”
- Calculus Concept Readiness test (MAA) [provides general statements key pre-calculus outcomes]
- Covariational Reasoning [Arizona State]
- Dana Center STEM Path [Connects dev math reform to pre-calculus reform]

Next?

- Change happens locally … reform occurs when change is not bound locally
- Together, MichMAA and MichMATYC can facilitate reform in courses like pre-calculus
- Can we create a shared task-force? Some other structure?