Pre-Calculus
Three Communities – One Goal
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Success across three education systems:
A longitudinal study of mathematics and statistics transitions

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Overview

1. Mathematics at all levels
2. Transition issues
3. NSF funded study of student transitions
4. Data sources
5. Some preliminary results
Mathematics at all levels

• Mathematics in high school opens doors
  – Best single predictor of college success
  – STEM Careers, including mathematics and statistics
  – Other ‘hot’ careers with increasingly quantitative skill set
  – Prerequisite for active citizenship

• Mathematics in college often closes doors
  – Students often plan how to get into college, but forget about the mathematics requirements
  – Not passing entry level mathematics courses, such as Calculus I, closes doors to all STEM careers
  – Attitudes in remedial courses, such as pre-calculus, close many doors
  – Pre-calculus (trigonometry and analytical geometry) alone force about 150 ISU students per year to change majors away from STEM
  – Pre-calculus alone maybe responsible for about 350 students leaving ISU per year
Transition issues

• Transition issues may be to blame for many problems students face when entering college
  – Different course content
  – Different course delivery
  – Social and personal issues

• High schools, community colleges and 4-year institutions need to face academic transition issues together, i.e. in coordinated way

• But what exactly are the “key” academic transition issues?

• Goal: for any student walking into the door of a college design the course sequence that promises maximum probability of success
NSF funded study of student transitions

A research group at ISU with faculty from Mathematics / Statistics / Education proposes to identify

- Course sequences that work, and those that need content redesign, alignment and coordination
- Gender issues related to mathematics/statistics courses that complicate completing a STEM degree
- Instructor and course delivery variables that affect successful course completion
- Student attitudes towards mathematics/statistics in entry level courses that may support or impede course completion
- Student academic characteristics that make certain course sequences more adequate
- Coordination issues between high schools, community colleges, and Iowa’s public universities.

- Requires:
  longitudinal study high school – community college – 4-year college – graduation
Data sources

• University student data base
  – Part of student academic history, such as HS and CC math courses
  – ACT and/or SAT scores
  – Course and grade history at university

• Departmental course and instructor data bases: For each section of each course:
  – Section delivery data
  – Instructor data
  – Evaluation data

• Student efficacy and attitude survey

• Iowa Department of Education student high school data
Some preliminary results

The precalculus courses Math140 (‘college algebra’), and Math142 (trigonometry, analytical geometry)

Consider achievement in Math142 depending on where Math140 was taken:

• Students who took Math140 at ISU and 4-year college transfers do a bit better than students coming directly from high school, who do better than students coming from a CC
• Students for whom the ISU student data base has no precise record of their college algebra course, have very large D-F-X rates.
• This group includes students who took ‘college algebra’ via dual enrollment, or who took college algebra a few years back, etc.
• Introductory statistics courses show a similar picture, if one takes ‘repeats’ into account.
Some preliminary results – 2

The precalculus courses Math140 (‘college algebra’), and Math142 (trigonometry, analytical geometry) – continued

• Students entering ISU directly from high school do well in Math142 if they had calculus or trigonometry in high school, lower level high school mathematics does not work.
• Female students had a 10% better chance of success (i.e. obtaining an A-B-C grade).
• We do not know (yet) the precise effect of large lectures and online sections.
• Overall success rate in Math 142 is below 40% in recent years.

new placement exam
redesign of pre-calculus courses at ISU
These data are only for students for whom ISU has ACT results, the results were obtained by the ISU Office of the Registrar.

- The courses calculus I (Math 165) and Calculus II (Math166): Students who took Calculus I at Iowa State do about as well in Calculus II as students with AP calculus credit, 2-year early credit students (dual enrollment) do worse, and CC transfers have the lowest scores.

- The same results hold for the Calculus II and Calculus II pair of courses.

- For the Business Mathematics course sequence Math150 and Math151 the results show that CC transfer students do worse than students who had Math150 at ISU.