A Calculus II Diagnostic that Identifies Gaps in Pre-requisite Knowledge

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Motivation

MATH 101
- is *Integral Calculus with Applications to Physical Sciences and Engineering*
- is offered in Term 2
- is a “Calculus II” (C2) course
- its only pre-requisite is: any “Calculus I” (C1) course

Project Goals
- develop a formative assessment that identifies C1 knowledge gaps and predicts C2 success
The Diagnostic

- An in-class diagnostic test was administered
  - in one section of MATH 101,
  - in early January 2012.

- The diagnostic
  - asked students when they took C1,
  - asked students which C1 course they took,
  - contained 9 questions on C1 concepts,
  - contained multiple-choice and short answer questions, and
  - contained conceptual and computational questions
Diagnostic Results

- 183 students wrote diagnostic
- Only 63% of students completed C1 in previous semester (2011/12)

C1 Completion Dates

- 63% 2011/12
- 25% 2010/11
- 7% pre 2010
- 5% S2011

C1 Course Distribution

- 53% MATH 100
- 21% MATH 102
- 17% MATH 180
- 9% Other

MATH 100: Differential Calculus with Applications to Physical Sciences and Engineering
MATH 102: Differential Calculus with Applications to Life Sciences
MATH 180: Differential Calculus with Applications to Commerce and Social Sciences
Diagnostic Scores

- Students that completed C1 recently out-performed their peers
- Areas where students struggle identified
- Were some diagnostic questions too difficult?

![Average Score Per Question](chart1)

![Total Scores on Diagnostic](chart2)

\[\text{Completed C1 in 2011/12} \quad \text{Completed C1 in 2010/11}\]

Difference in diagnostic total scores significant, \(t\)-test, \(p < 0.0002\)
Midterm Grades

- Midterm grades higher among those that completed C1 in 2011/12
- Do 2010/11 students need additional support?

Differences significant on both midterms, *t*-test, *p* < 0.0002
Midterm/Diagnostic Correlations

• individual diagnostic question scores and midterm scores correlated (point-biserial coefficient)

• identified some questions that predict student success in MATH 101

Correlation To Term Grades

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<tr>
<th>Question Number</th>
<th>Correlation Coefficients</th>
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Future Work

- Further analysis with MATH 101 final grades
- Refinement of diagnostic questions for future C2 courses
- Development of learning module and assessment that address identified knowledge gaps

Acknowledgements

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