



Interactivity and Intervention

An Overview of Calculus Redesign at Missouri S&T

Where We Began – Summer 2013

Campus Strategic Plan

- Redesign high-volume courses through integration of new technology and modified teaching methods to enhance student learning
- Four-year target: Increase calculus success by 7%
- One of three funded strategic plan initiatives on campus

What is redesign?

The definitions of course redesign differ greatly.

Looked at other redesigns:

- Chem 1 and others on campus

- Chattanooga State

Instead of focusing on the big picture of what others have done, we decided to focus on what others have done that addresses the areas we need to improve.

Four Core Components

Redesigned, interactive labs

Enhanced departmental training for GTAs

Online supplementary video library

A new program for underperforming students

Traditional Labs

Traditional Calculus I and II labs

- Meet two days per week for 50 minutes
- 40-50 students per lab
- Are run by GTAs with minimal training
- Are not standardized
- Do not encourage student engagement
- Are generally quite ineffective

Redesigned Labs

Redesigned Calculus I, II, and III labs will

- Meet one day a week for 75 minutes
- 30 students per lab
- Be run by GTAs with focused training
- Be standardized
- Encourage engagement through interactivity

Timeline for Lab Redesign

	FS 14	SP 15	FS 15	SP 16	FS 16	SP 17	FS 17
Calc I	Pilot 1	Pilot 2	All				
Calc II			Pilot 1	All			
Calc III				Pilot 1	All		

Fall 2014 – Calculus I Lab Pilot

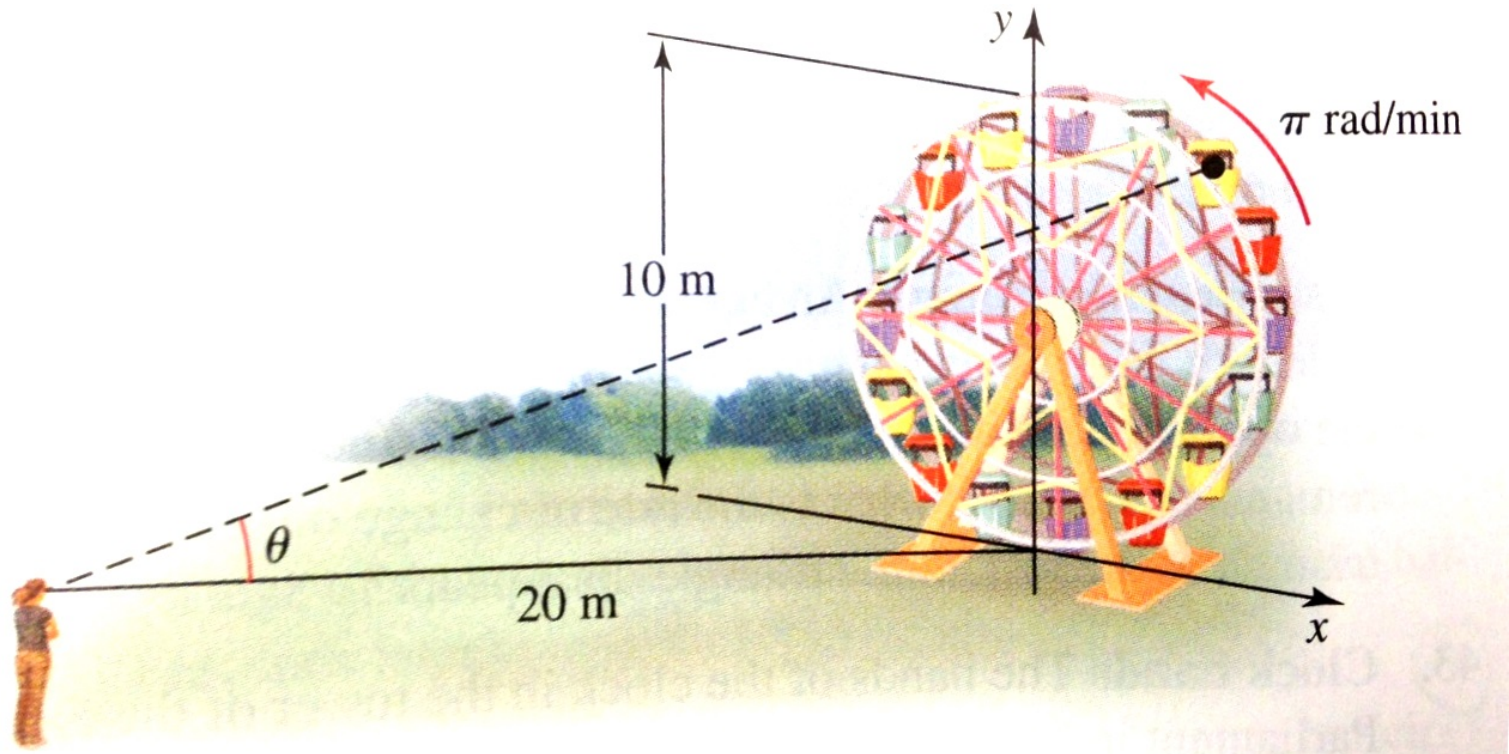
Four lectures

- Three lectures with traditional labs
- One lecture with redesigned labs
 - Labs run by faculty

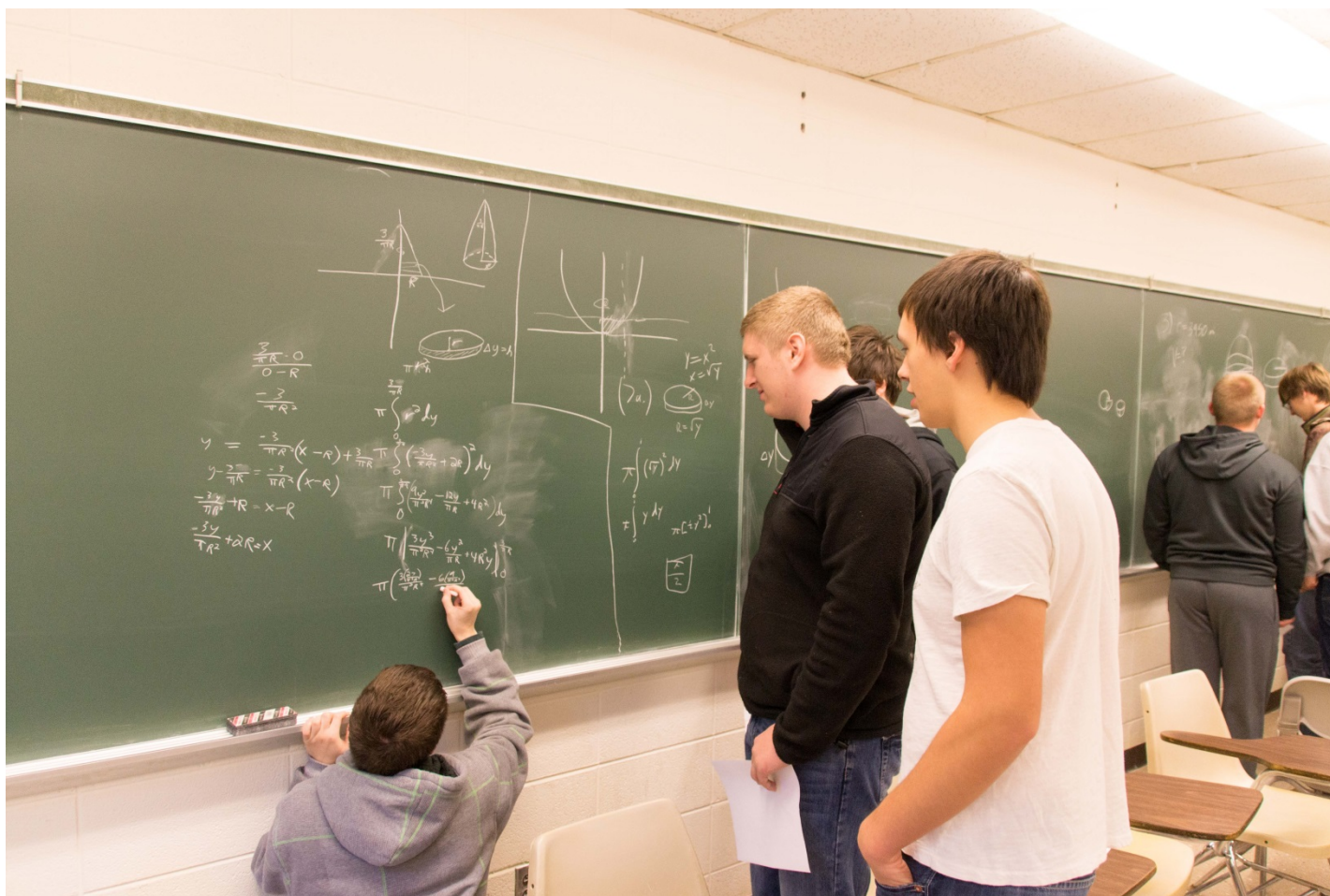
Structure of Redesigned Labs

- Activity Worksheet provided at start of class
 - Not graded
 - Separate from online homework
- Students work on problems in groups of 4-5 at the board
- Individual students present solutions

1. An observer stands 20 m from the bottom of a 10 m tall Ferris wheel on a line that is perpendicular to the face of the Ferris wheel. The wheel revolves at a rate of π rad/min and the observer's line of sight to a specific seat on the wheel makes an angle θ with the line of sight from observer to the bottom of the wheel. Forty seconds after that seat leaves the lowest point on the wheel, what is the rate of change of θ ? Assume the observer's eyes are level with the bottom of the wheel.



Redesigned Labs in Action



Redesigned Labs in Action



Redesigned Labs in Action



Current GTA Training

Mathematics and Statistics GTA training currently has two components

- Campus GTA workshop
- Departmental GTA seminar

These components are not coordinated and do not adequately prepare GTAs

Redesigned GTA Training

The redesigned training will

- Be unified, cohesive, and interactive
- Prepare incoming GTAs to present material clearly and facilitate interactive learning
- Be modeled off the successful mathematics GTA training at University of Michigan
- Be “fully” implemented for Fall 2015

Extensive Online Video Library

We are producing an extensive library of short videos on calculus and prerequisite topics.

- Prerequisite videos will facilitate just-in-time review
- Some videos will go beyond what is normally covered in lecture
- All videos will be closed captioned

What Do Underperforming Students Do Now?

Underperforming students choose to

- Drop before the 6 week deadline
- Change to hearer status
- Withdraw
- Fail the course

None of these options improve a student's background before they retake the course.

Can Underperforming Students Be Identified?

Calculus I for Engineers

Fall 2013 – 468 students

Fall 2014 – 428 students

Grades compared from two dates:

- After Exam 2 (Week 8)
 - Excludes online homework
- End of Semester
 - Includes online homework

Can Underperforming Students Be Identified?

Fall 2013	A, B, C after E2	D after E2	F after E2	Total
Total Students	364	49	55	468
Passed (A, B, C)	299	4	0	303
Failed (D, F)	63	33	31	127
Withdrew	2	12	24	38

Fall 2013	A, B, C after E2	D after E2	F after E2	Total
Total Students	342	35	51	428
Passed (A, B, C)	292	3	2	297
Failed (D, F)	48	32	36	116
Withdrew	2	0	13	15

A New Program for Underperforming Students

We are going to provide an option for underperforming students which

- Allows students to maintain full-time status
- Does not result in a GPA penalty to students
- Provides students with a structured opportunity to work on their deficiencies with prerequisite material

A New Program for Underperforming Students

New Course: “Success for Calculus”

- 4 credit hours (3 lecture, 1 lab)
 - Same as Math 1214 (Calculus I for Engineers)
- Proposed Catalog Description:

This course focuses on the use of college algebra and trigonometry skills within the context of calculus, providing students with the opportunity to improve their preparedness for future calculus coursework.

A New Program for Underperforming Students

New Course: “Success for Calculus”

- First offered in Fall 2015
 - Will be available both fall and spring
- Only offered on a pass/fail basis
- Prerequisite: Consent of Instructor
- Students will only be allowed to take the course one time, regardless of outcome

A New Program for Underperforming Students

New Course: “Success for Calculus”

- Calculus I students with a grade below 65% after Exam 2 will be strongly encouraged to take the success course
- Replaces Calculus I on schedule and transcript
- Will not be mandated
 - If participation is low, we may revisit the idea of mandating the success course for certain students

A New Program for Underperforming Students

New Course: “Success for Calculus”

- Begins in Week 9
- Blended Course
 - Lecture one day per week (50 minutes)
 - Remainder of the course delivered online
- Two exams, plus a final
 - Will use the same exam dates/times as Calculus I

Another Look at Calc I Success Rates

	Fall 2013 – All	Fall 2014 – All	Fall 2014 – New
Total Students	468	428	271 (63.3%)
Passed (A, B, C)	303 (64.7%)	297 (69.4%)	225 (83.0%)
Failed (D, F)	127 (27.1%)	116 (27.1%)	41 (15.1%)
Withdrew	38 (8.2%)	15 (3.5%)	5 (1.9%)

Fall 2014 – 46.3% of incoming freshmen started at Calculus I or higher



Any questions?