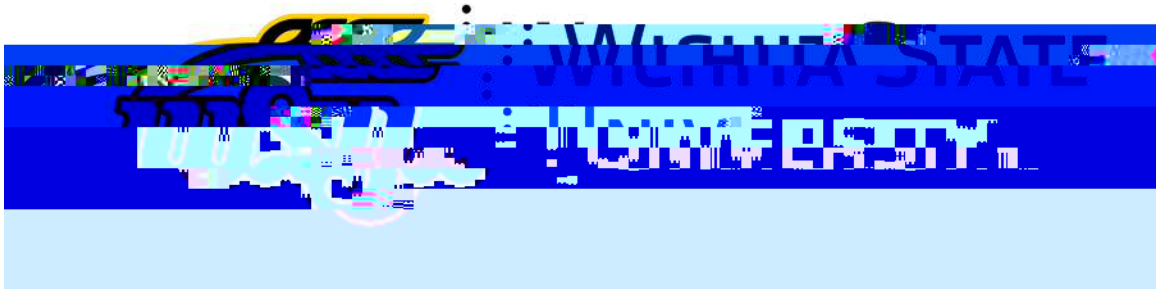
Student Performance Characteristics in a Hybrid Engineering Statics Course



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Presentation Outline

Background and motivation

Describe the advantages of hybrid-style course

Define topical coverage and exam structure

Discuss student performance for exams during the semester

Obtain a benchmark for performance based on cumulative averages

Background

Significant growth & demand for STEM graduates in U.S.

Motivation for Benchmark Data

Hybrid class by the first author has a comparable pass rate

To increase retention and improve student success, interventions will be necessary

- However, the efficacy of interventions cannot be objectively assessed without a benchmark

Goal is to obtain a benchmark for student performance over the course of the semester for a hybrid Statics class

Advantages of Hybrid Course

A hybrid course includes videos of concept development and example problems viewed outside of class

- The videos allow students to go over difficult concepts multiple times by pausing and rewinding the videos
- Dovetails with current students who desire study material any time, anywhere

Opens up class time to solve additional examples and spend time on review prior to exams

Class periods become available to increase the number of exams, each of which become a smaller fraction of the final grade

- Section coverage in each exam becomes limited rather than wide-ranging, so exams are more like quizzes in terms of coverage

Dataset for the Benchmark

Dataset consists of 343 students in the first author's hybrid classes

- 152 students in four 50-minute sections with 7 regular exams
- 117 students in three 75-minute sections and 74 students in two 60-minute sections (i.e., 191 total students) with 6 regular exams
- In addition to regular exams, all students took a prerequisite knowledge test at the start of the semester and a comprehensive final exam

~11% of the students withdrew from the course with a grade of W

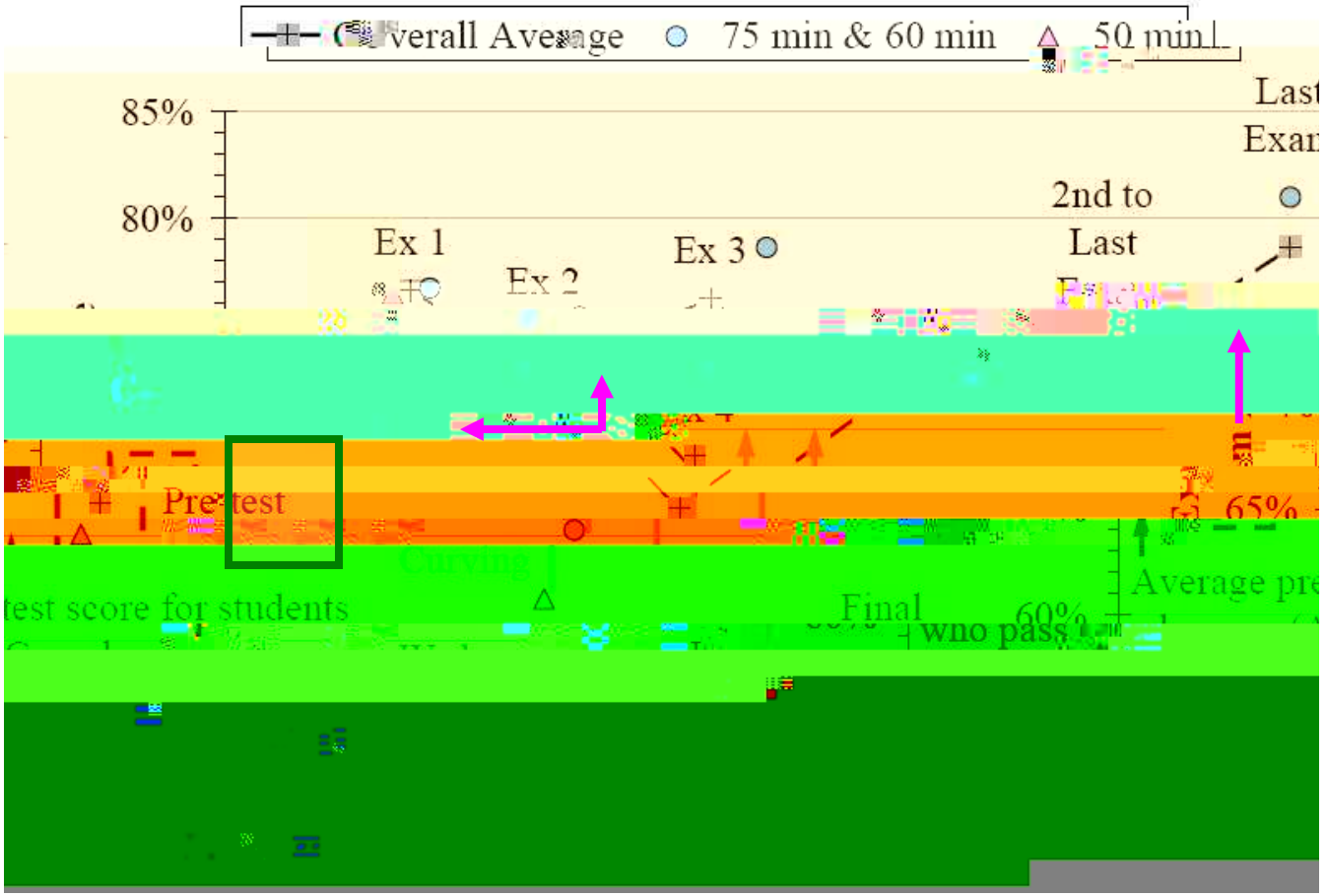
- Some students remained in the class even though they were flunking at 10th week, often to maintain financial aid or immigration status
- Those who did not take the exams were not a part of the cumulative averages – change in class composition can affect statistical results

Individual Exam Averages Over the Course of a Semester

Performance by 50-min class was **lower** than 60- & 75-min classes

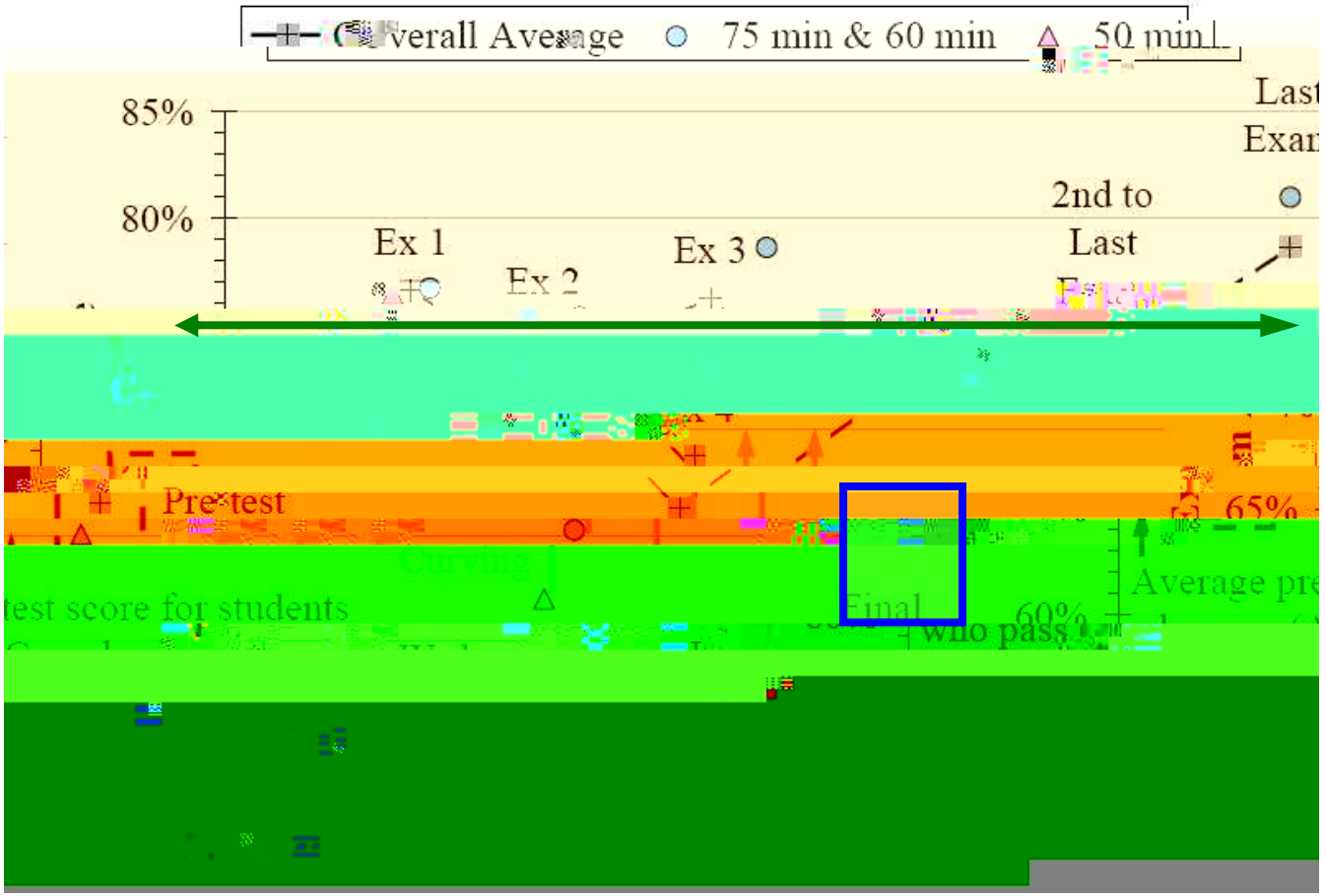
Reason: they were less capable as indicated by lower prerequisite test score (topic of earlier paper)

Exam 1 is review so many do very well, but this is not evident from the average



Individual Exam Averages Over the Course of a Semester

- Result on exam over frames is poor because it is the most difficult material in course
- Except for frames, exam performance appears relatively constant (to ±5%)
- Poor students dropping over time masks difference in performance
- Need to look at cumulative ave



Cumulative Statistics (Average & Standard Deviation) During Semester

	61.6%	62.0%
	(111)	(76)*

Divided into groups: those that pass, all (reference), and not passing

Cumulative average do not vary significantly within each group

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Correlation Between Exam Scores and Semester Grade

Correlation coefficient between **individual** exams & semester grade:

Pre-test	Exam 1
0.457	0.628

Pre-test = moderate correlation Exam 1 (only) = moderately high

Correlation coefficient between **cumulative** ave & semester grade:

very high near perfect correlation

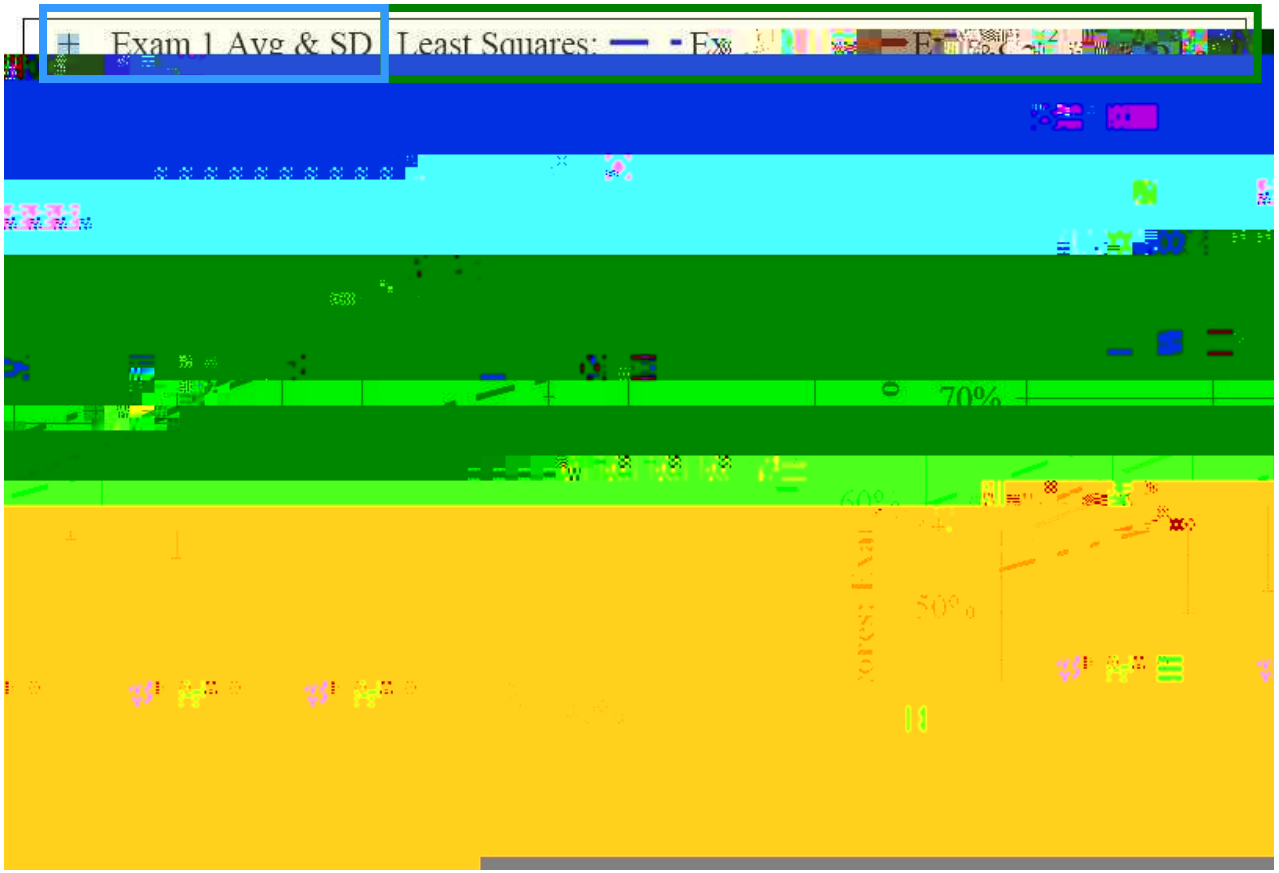
Very high correlation by the fourth exam, when the last day to withdraw with a grade of W occurs

Correlation Details: Pre-test, Exam 1 & 2 Average with Semester Grade

Least squares fit lines shown: Exam 1 (only), cumulative ave of Ex 1 & 2, and Pre-test (only)

Data points for Ex 1 & standard deviation (SD) at each grade pt are also shown

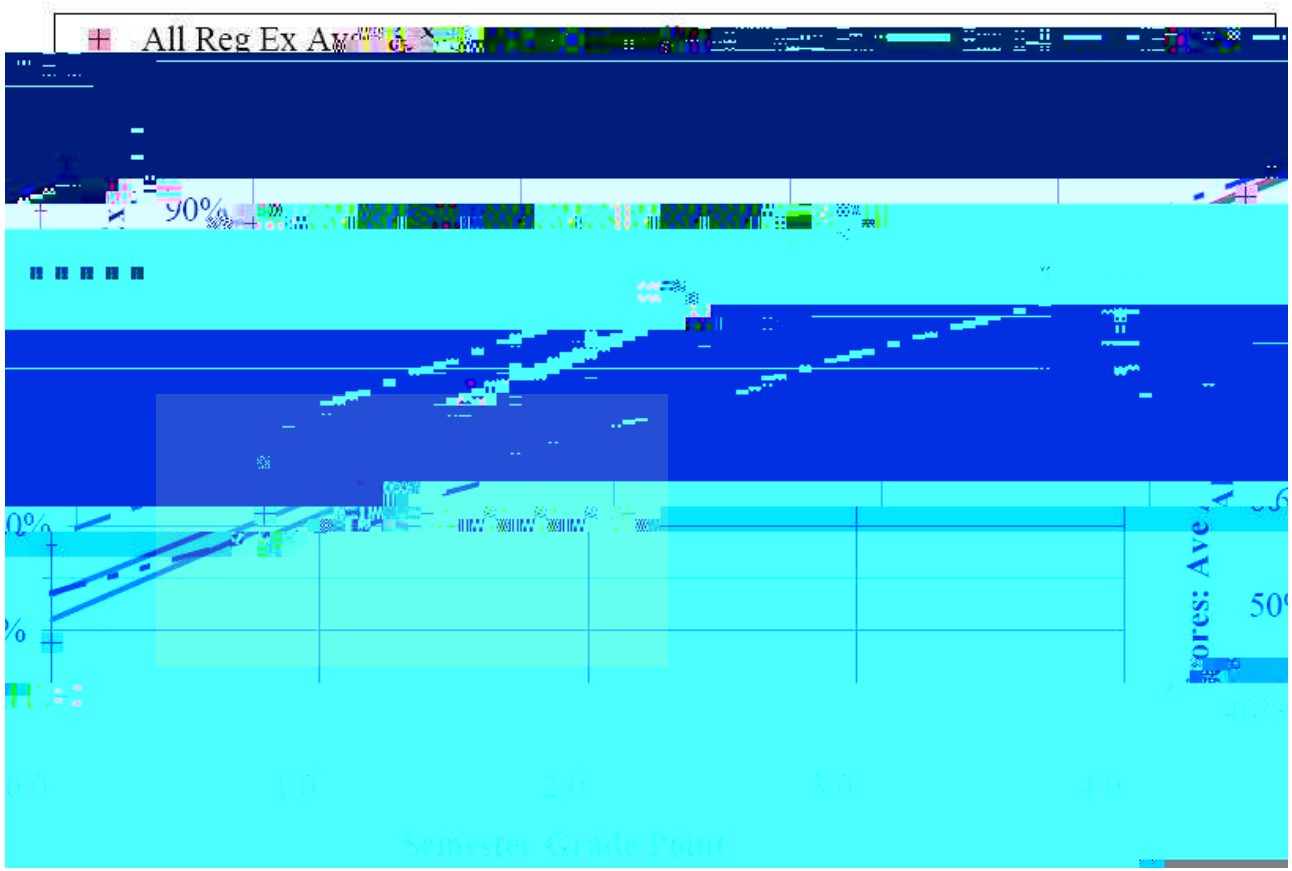
SD ("error") bars show range of values for each grade pt



Correlation Details: All Regular Exam Cumulative Average and Grade

After all regular exams (except for final exam):

- Not much shift in cumulative ave line except at lower grade levels
- Variance in scores has reduced to about +2% to 3%
- Results are close to grade level values & range as expected since correlation coefficient is **0.947**



Summary

Student performance characteristics in a hybrid Statics class were investigated

Cumulative averages did not vary much over the semester, but the distribution of scores varied a lot

Decreasing amounts of variance in the cumulative exam averages existed at each grade level as the semester progressed

By the withdrawal date, the cumulative exam average could be used with relatively good confidence to predict end-of-semester grades

There is a limit to the amount of improvement that is possible just with the final exam; i.e., after the completion of the regular semester exams

These results provide a benchmark for comparison in the future when interventions are made to affect student success in Statics at WSU