An Experiment in Teaching for Mastery in the MPH Core Curriculum

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Background

Introduction to Epidemiology (3 credits): A single 3-hour lecture class per week; 11 major topics & minimum grade requirement of B-

Phase 1: (10 years ago) Weekly problem sets: hard copy turned in, graded by instructor and TAs, and returned the following week with little feedback

Phase 2: Problem sets were created as "quizzes" in Blackboard (calculated numeric, T/F, multiple choice, multiple answer.

Automatic scoring and feedback on submission (30% of grade)

Observations:

1. Variability in quantitative skills
2. Students frequently asked for more practice problems
3. They uniformly appreciated immediate feedback

Bloom on Teaching for Mastery

"The variable that needed to be addressed, as Bloom saw it, was time. It made no pedagogical sense to expect all students to take the same amount of time to achieve the same objectives. There were individual differences among students, and the important thing was to accommodate those differences in order to promote learning rather than to hold time constant and to expect some students to fail. Education was not a race."

Thomas Guskey, a graduate student of Bloom's

A Study of Student Behavior

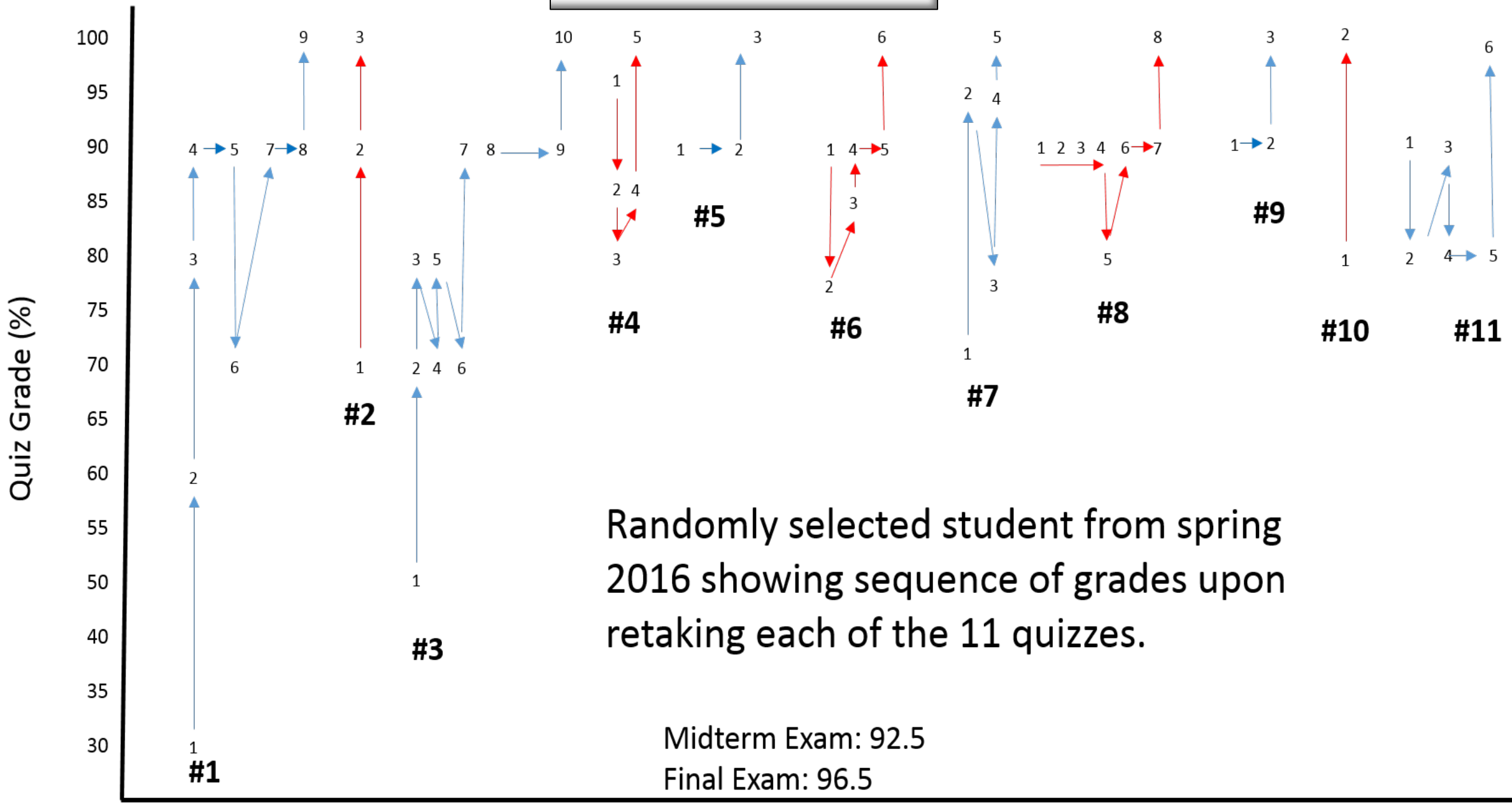
Phase 3:

- Question pools (40-90 questions) were created in Blackboard for each topic
- Questions from colleagues were vetted and careful feedback was added
- Created 11 weekly "tests" that drew 10 questions at random from a pool
- Students were required to complete each post-class quiz *at least once* within 1 week after the class ("open-book" permitted)
  - ➢ Test options set to allow unlimited attempts for the semester
    - o Fall 2015: Last quiz score recorded
    - o Spring 2016: Highest score achieved recorded
- Average score on the 11 quizzes made up 25% of semester grade.

Mean Quiz Scores

	Fall 2015 (N=51)			Spring 2016 (N=38)	
	Mean	SD		Mean	SD
1	97.1	7.7		97.5	5.6
2	94.8	8.5		94.5	9.0
3	96.3	7.5		93.9	13.3
4	96.2	6.5		95.2	10.1
5	96.7	5.7		95.6	7.0
6	95.5	9.3		93.8	15.3
7	97.7	5.4		97.3	5.0
8	94.5	9.1		95.4	7.0
9	97.4	6.6		96.6	7.1
10	96.0	6.2		94.6	11.0
11	99.0	4.3		93.7	16.7
Midterm Exam	83.9	10.2		89.4	10.1
Final Exam	**87.6**	10.8		**85.5**	14.2

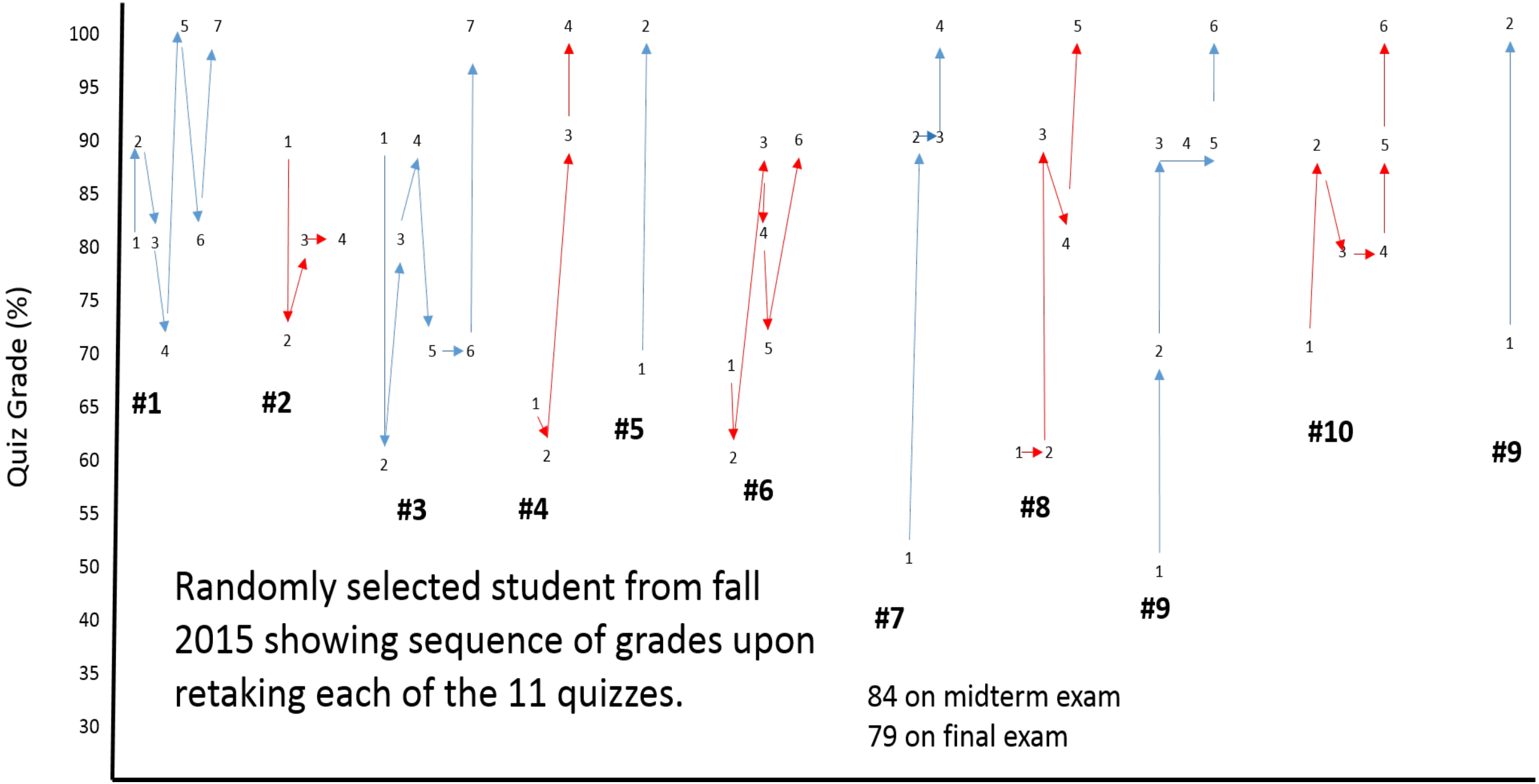
Typical Behavior



Randomly selected student from spring 2016 showing sequence of grades upon retaking each of the 11 quizzes.

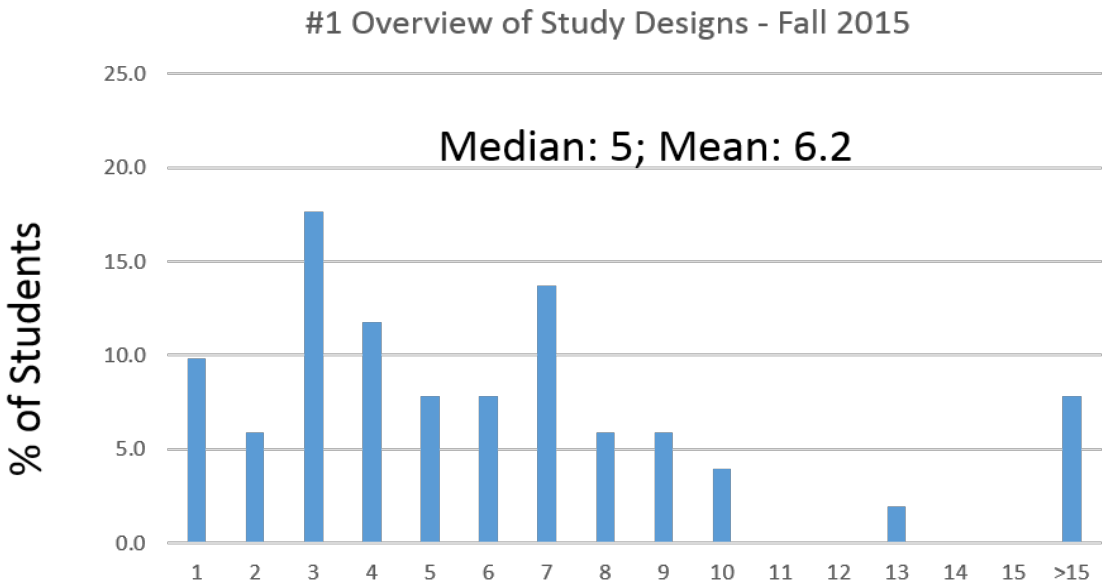
Midterm Exam: 92.5
Final Exam: 96.5

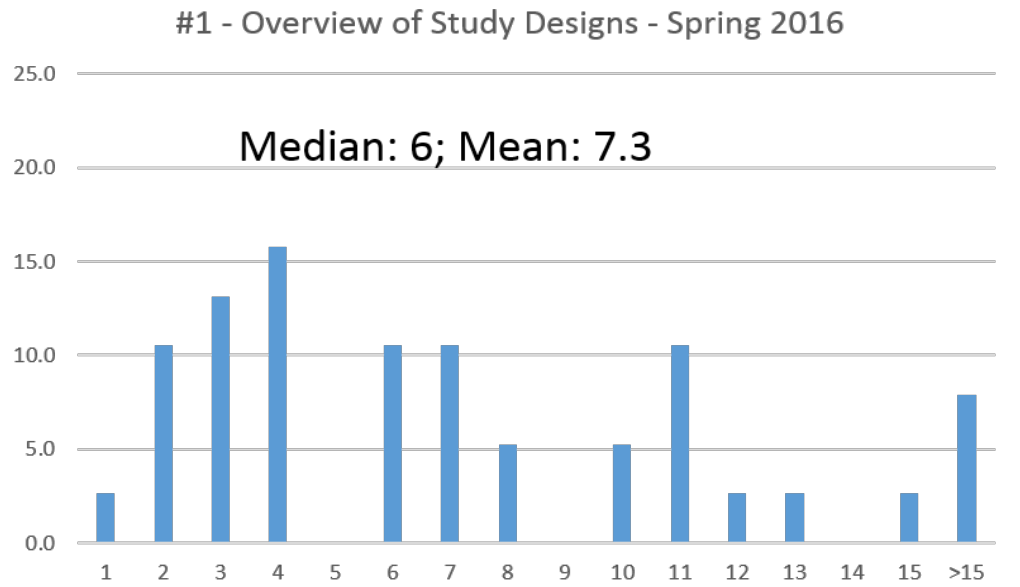
Another Student

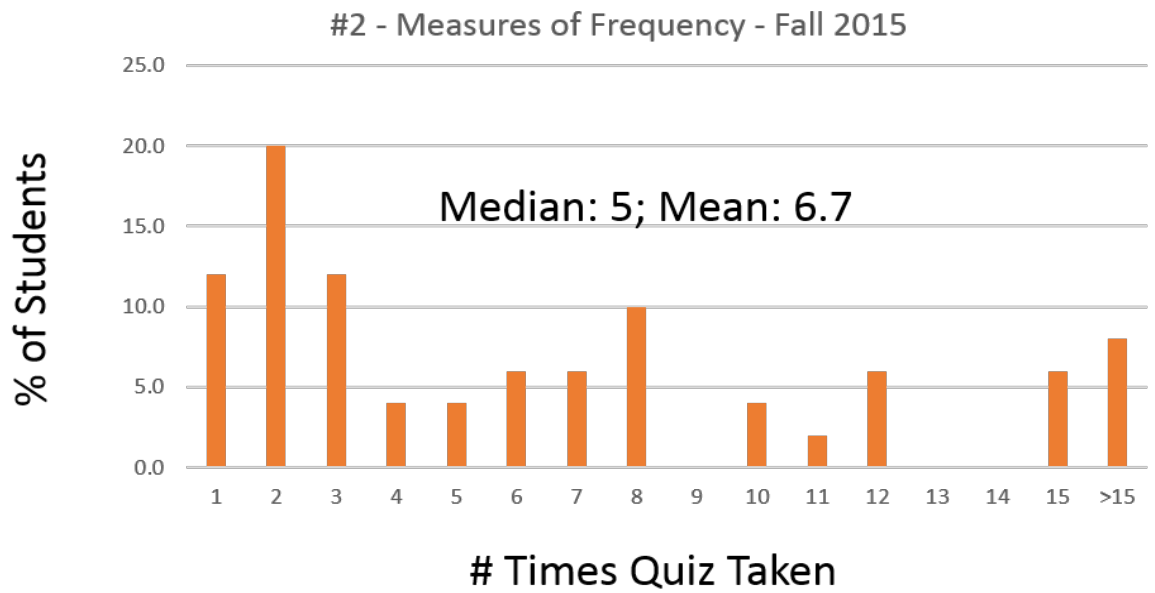


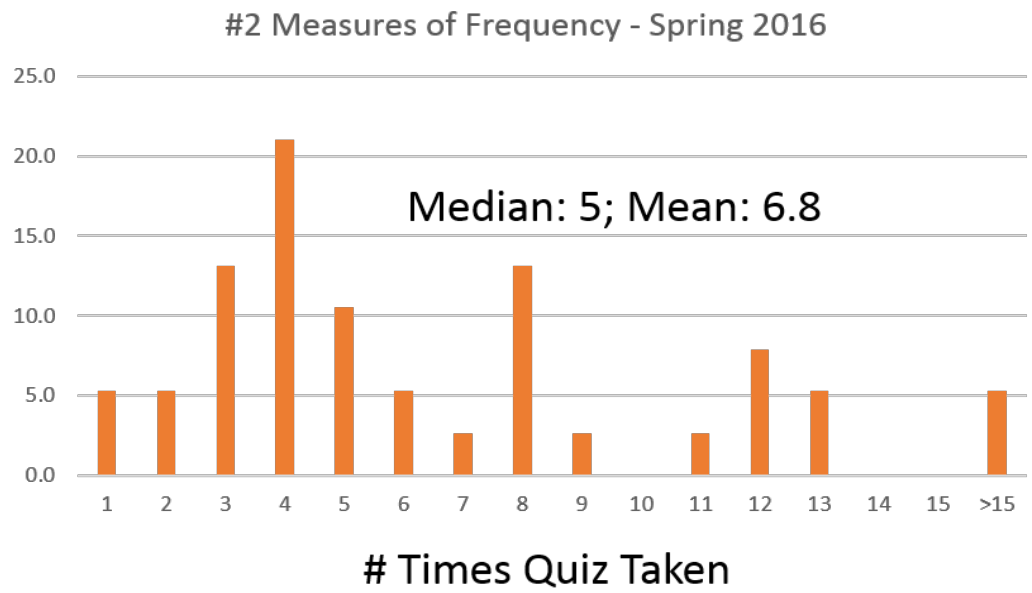
Randomly selected student from fall 2015 showing sequence of grades upon retaking each of the 11 quizzes.

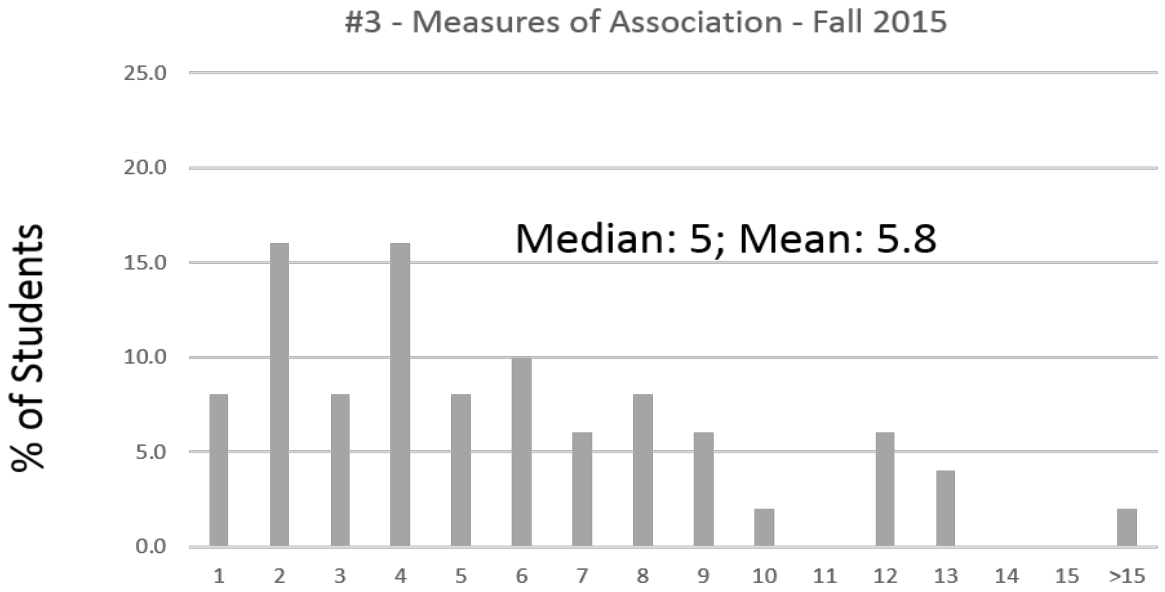
84 on midterm exam
79 on final exam

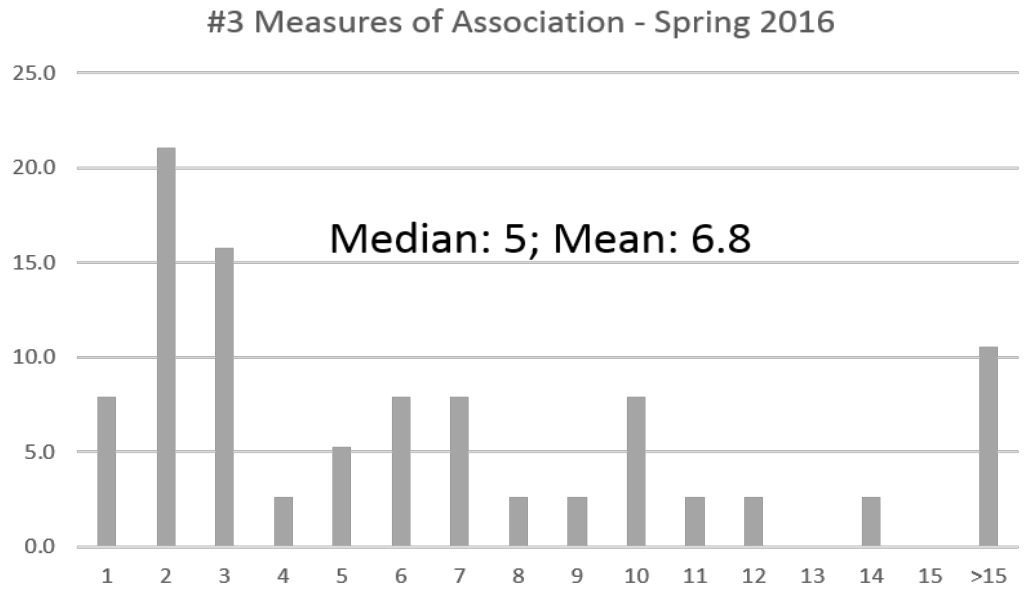

#1 Overview of Study Designs - Fall 2015
Median: 5; Mean: 6.2
% of Students
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

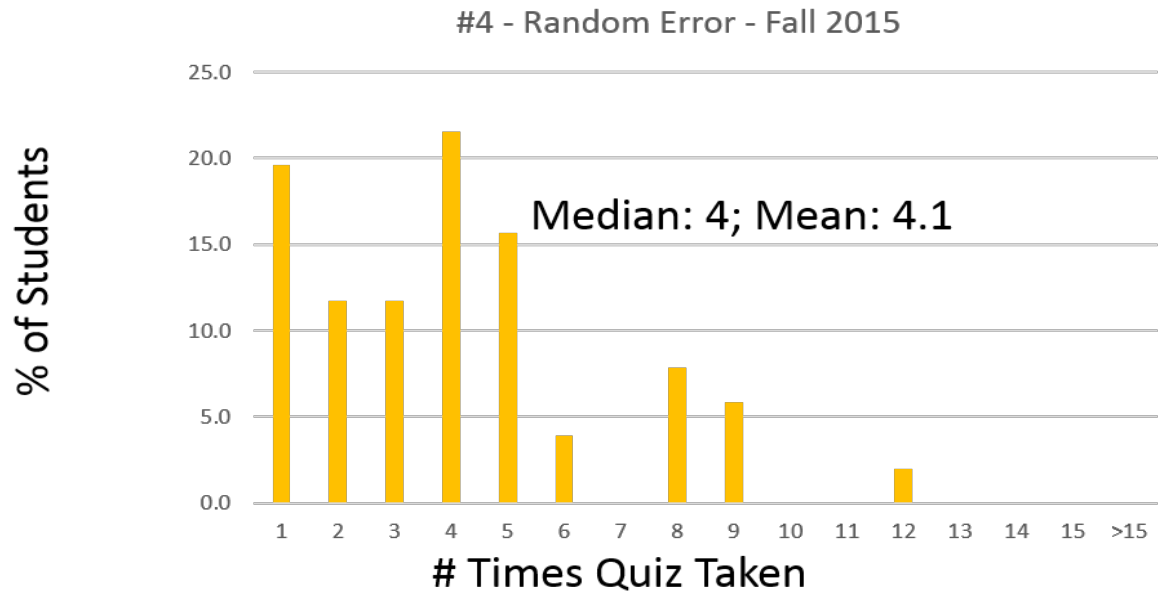

#1 - Overview of Study Designs - Spring 2016
Median: 6; Mean: 7.3
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

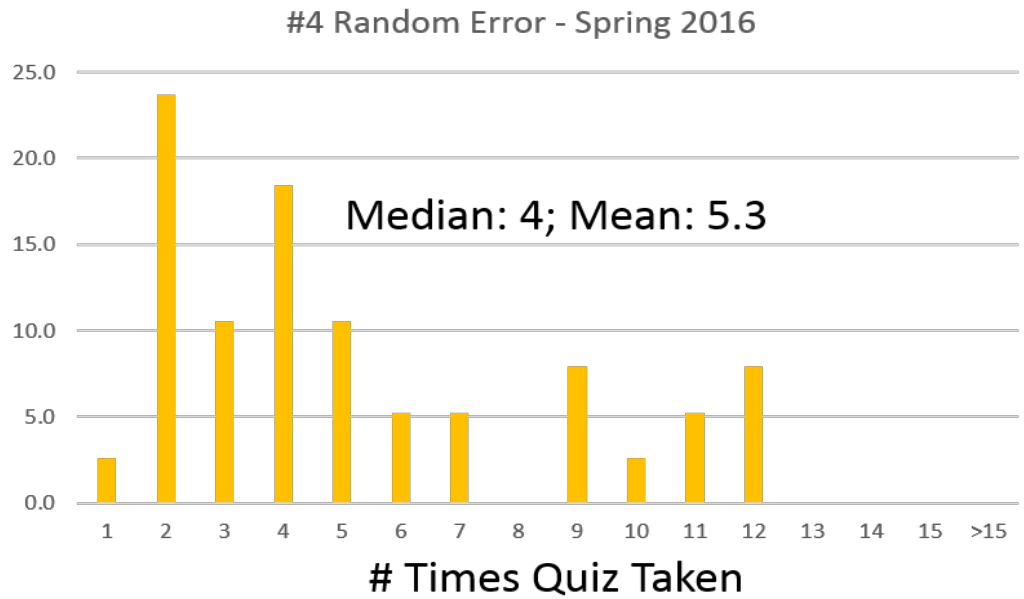

#2 - Measures of Frequency - Fall 2015
Median: 5; Mean: 6.7
% of Students
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

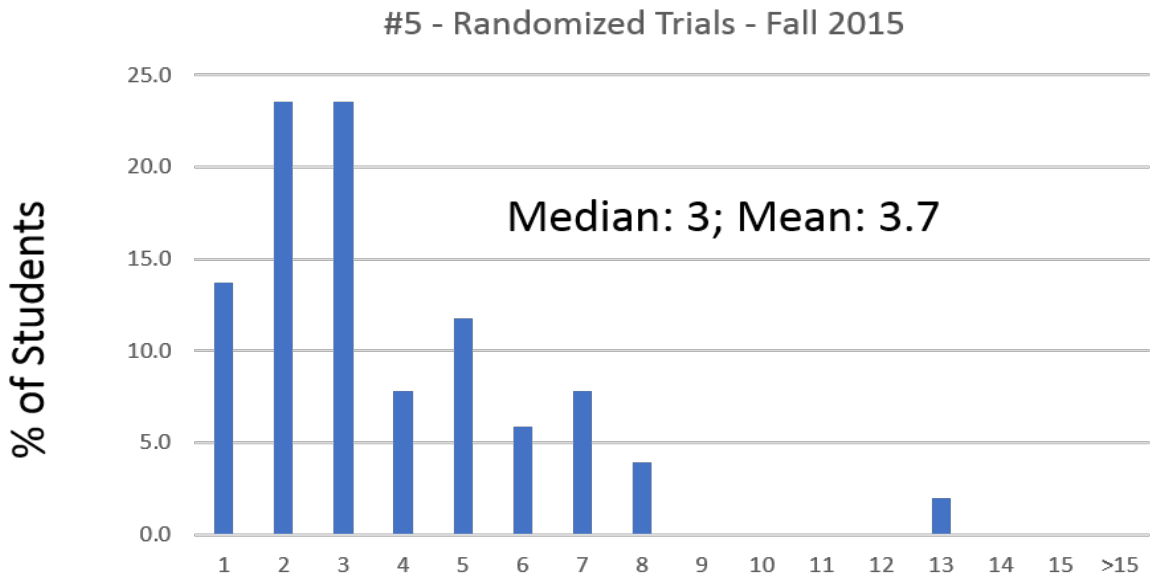

#2 Measures of Frequency - Spring 2016
Median: 5; Mean: 6.8
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

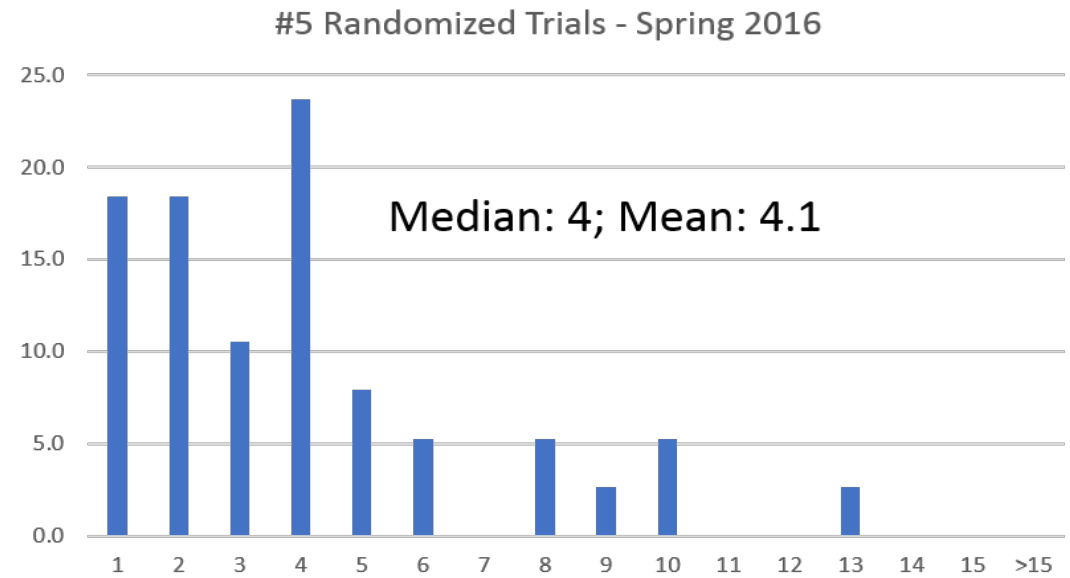

#3 - Measures of Association - Fall 2015
% of Students
Median: 5; Mean: 5.8
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

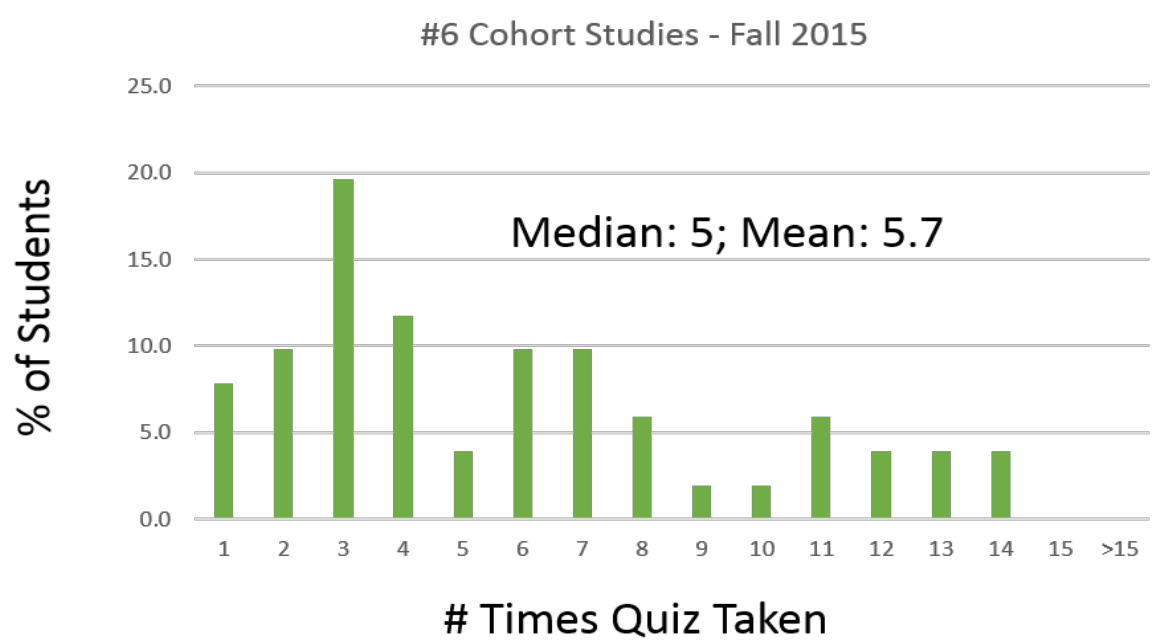

#3 Measures of Association - Spring 2016
Median: 5; Mean: 6.8
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

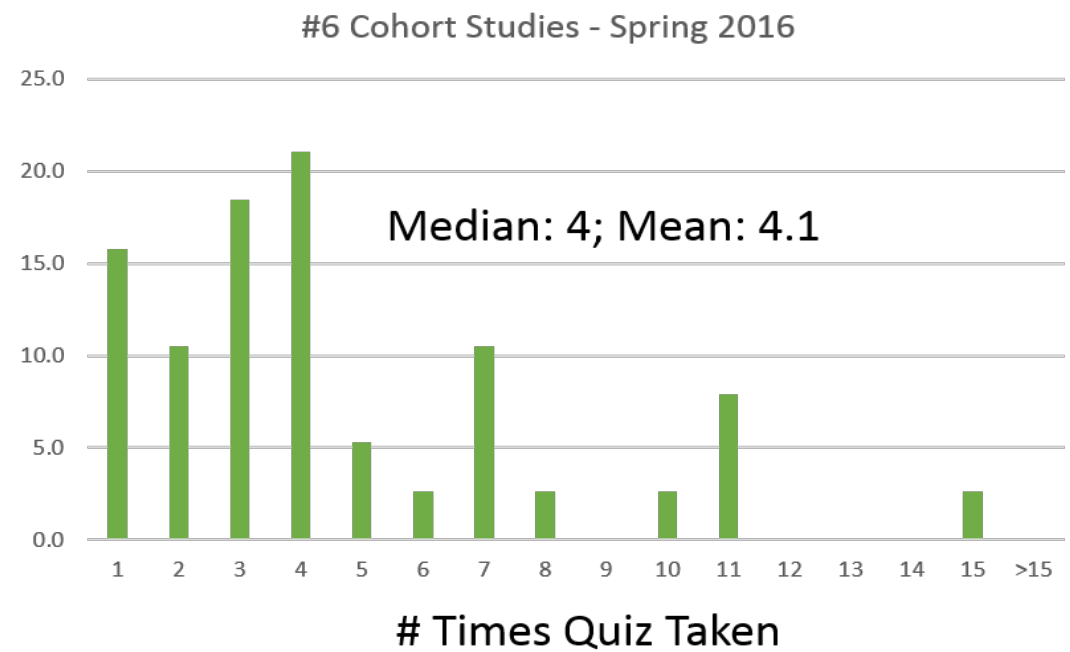

#4 - Random Error - Fall 2015
% of Students
Median: 4; Mean: 4.1
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

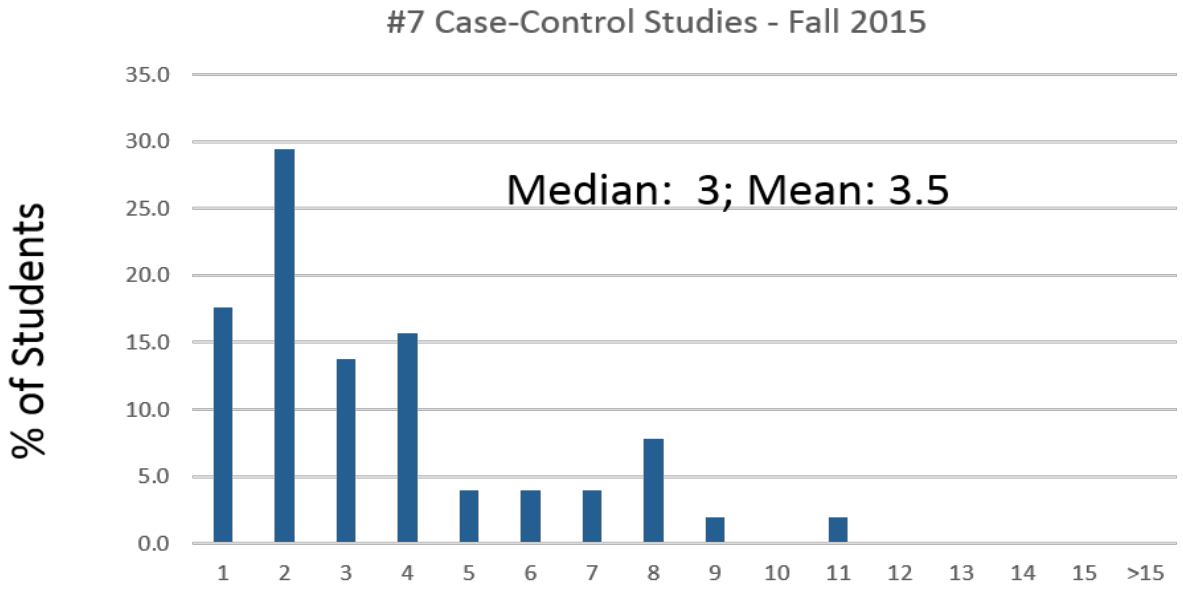

#4 Random Error - Spring 2016
Median: 4; Mean: 5.3
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

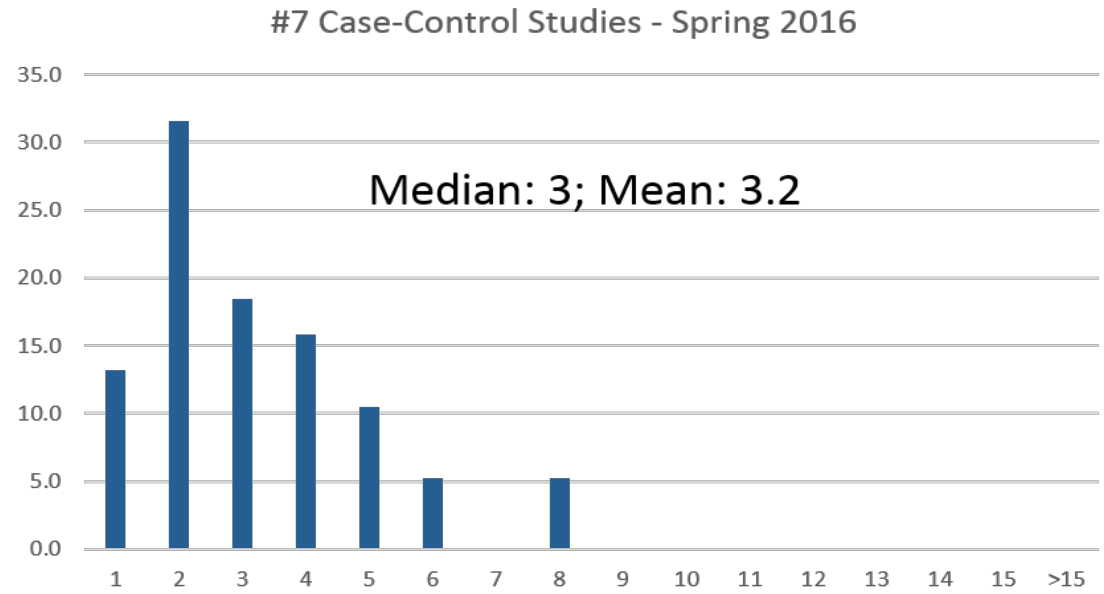

#5 - Randomized Trials - Fall 2015
% of Students
Median: 3; Mean: 3.7
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

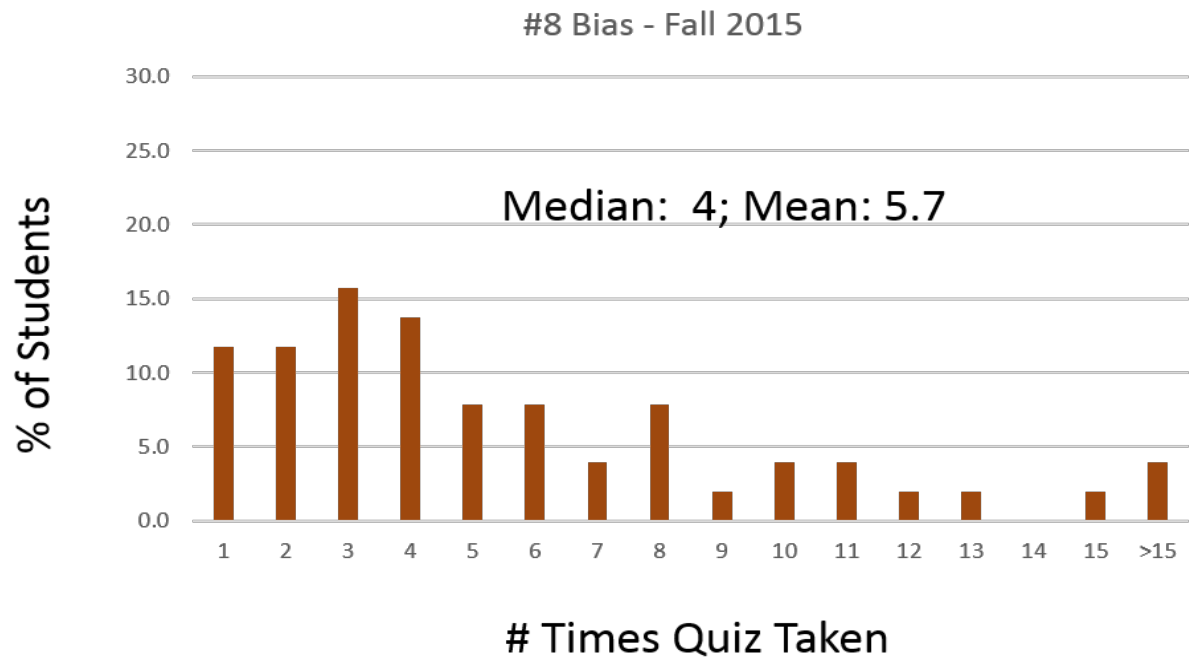

#5 Randomized Trials - Spring 2016
Median: 4; Mean: 4.1
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

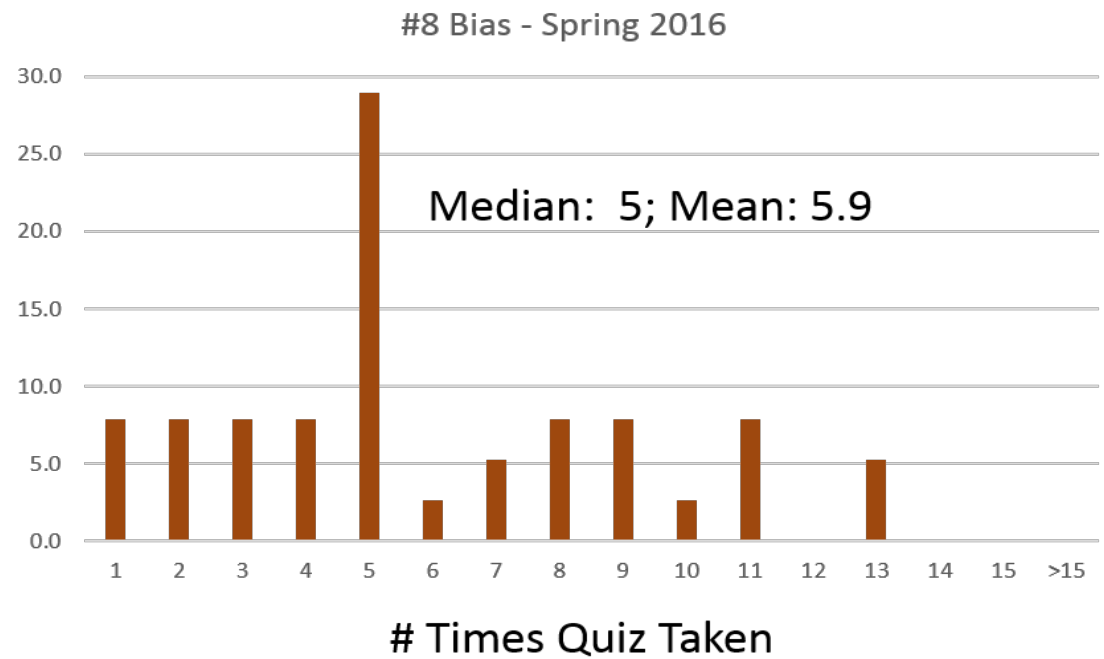

#6 Cohort Studies - Fall 2015
% of Students
Median: 5; Mean: 5.7
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

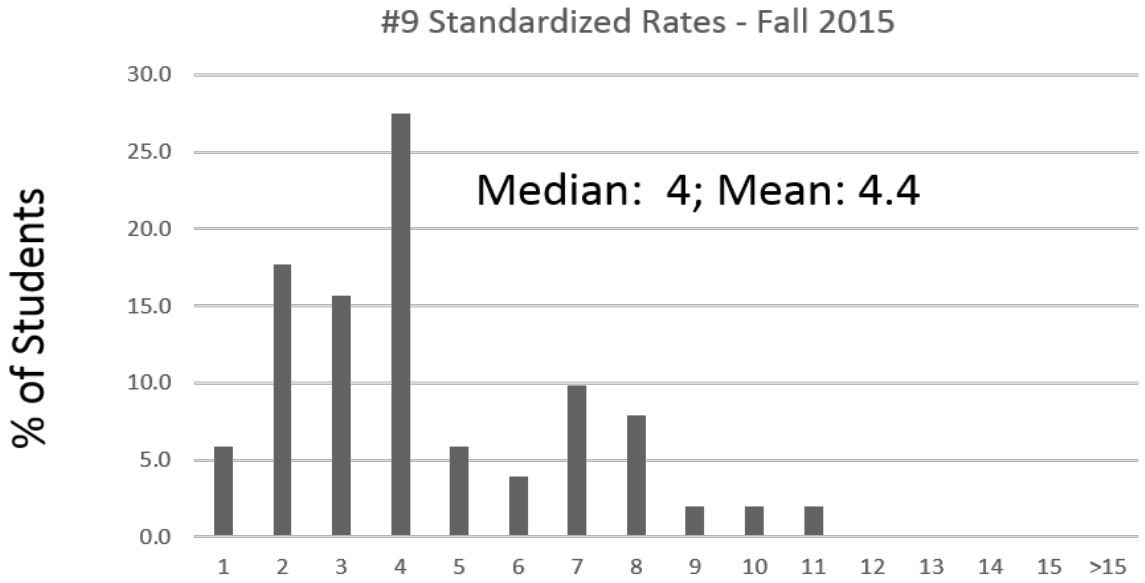

#6 Cohort Studies - Spring 2016
Median: 4; Mean: 4.1
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

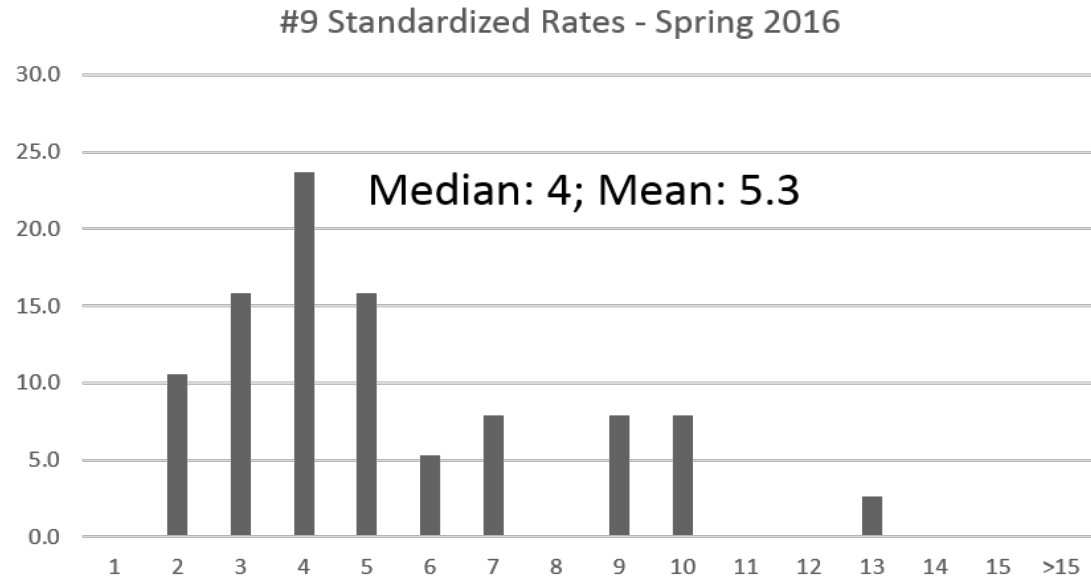

#7 Case-Control Studies - Fall 2015
% of Students
Median: 3; Mean: 3.5
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

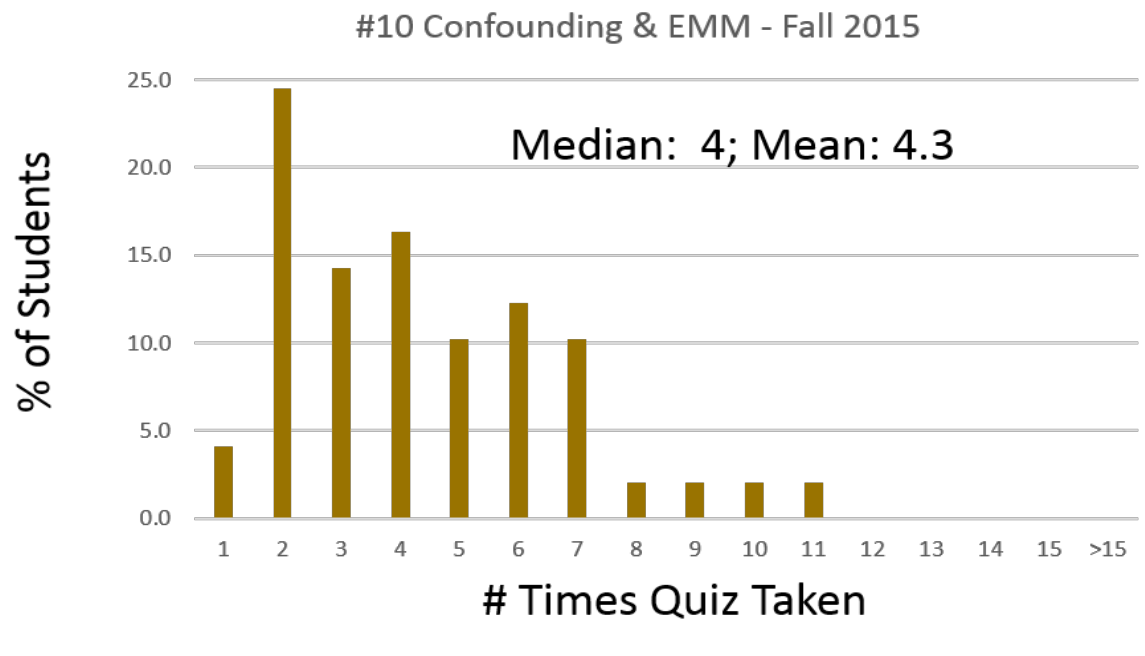

#7 Case-Control Studies - Spring 2016
Median: 3; Mean: 3.2
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

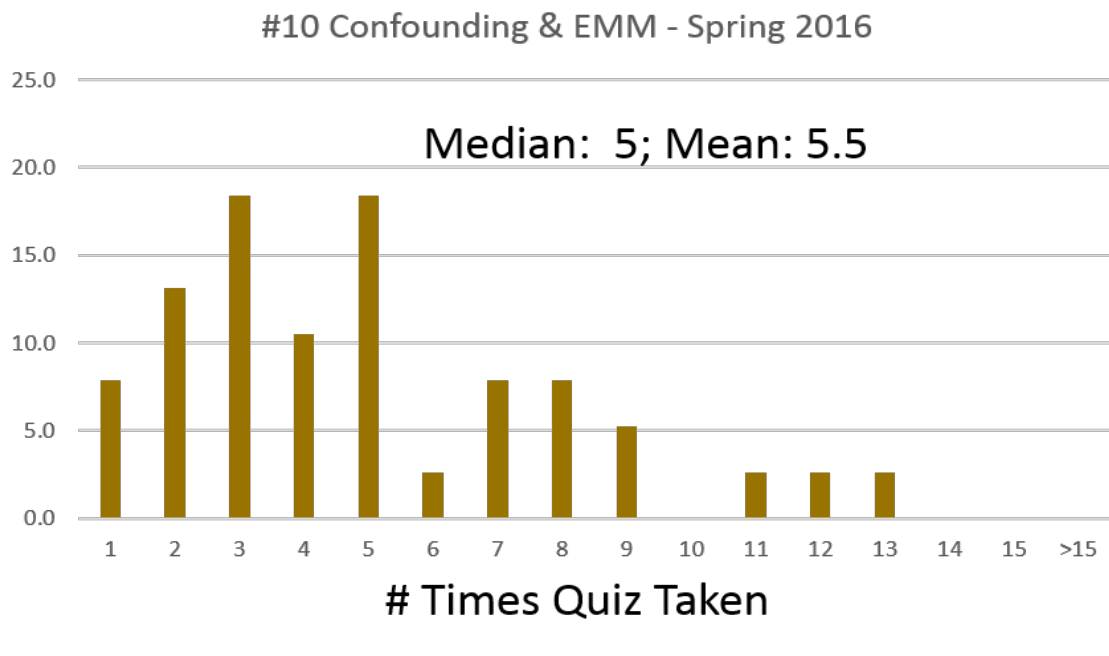

#8 Bias - Fall 2015
% of Students
Median: 4; Mean: 5.7
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

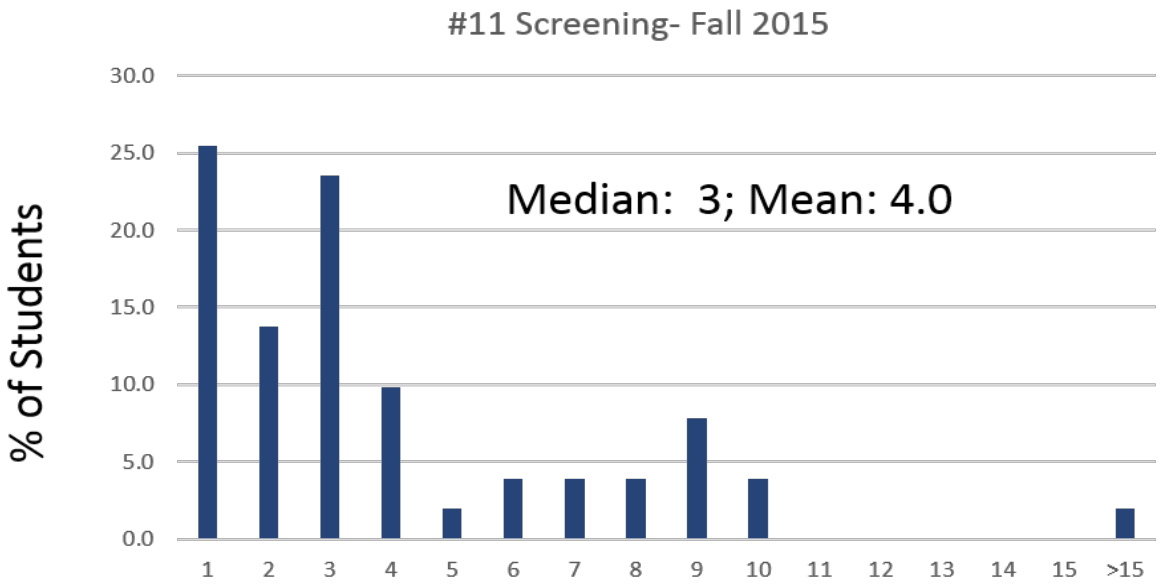

#8 Bias - Spring 2016
Median: 5; Mean: 5.9
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

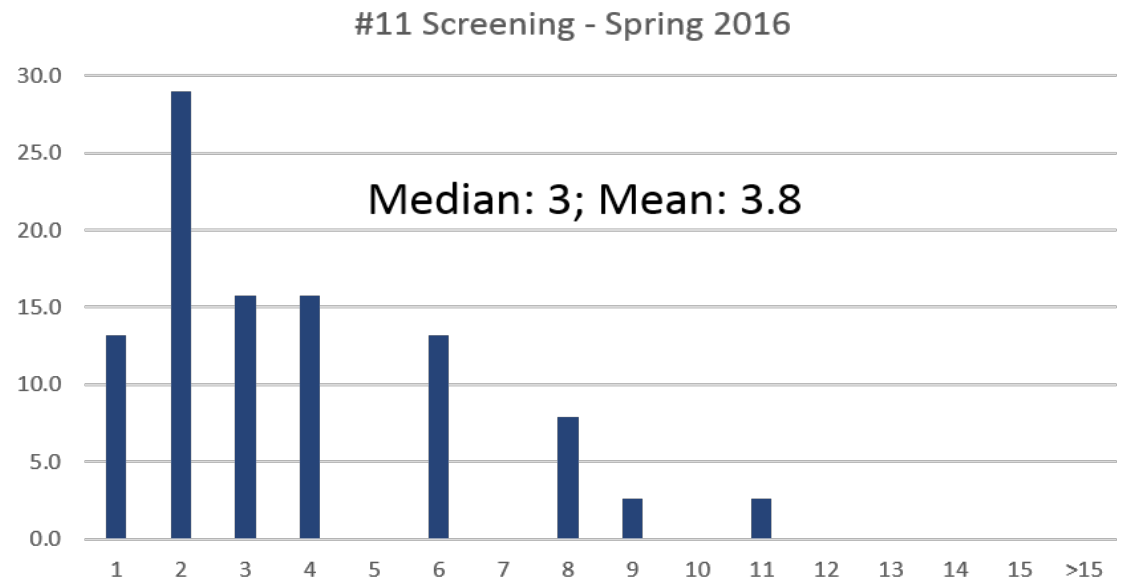

#9 Standardized Rates - Fall 2015
% of Students
Median: 4; Mean: 4.4
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15


#9 Standardized Rates - Spring 2016
Median: 4; Mean: 5.3
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

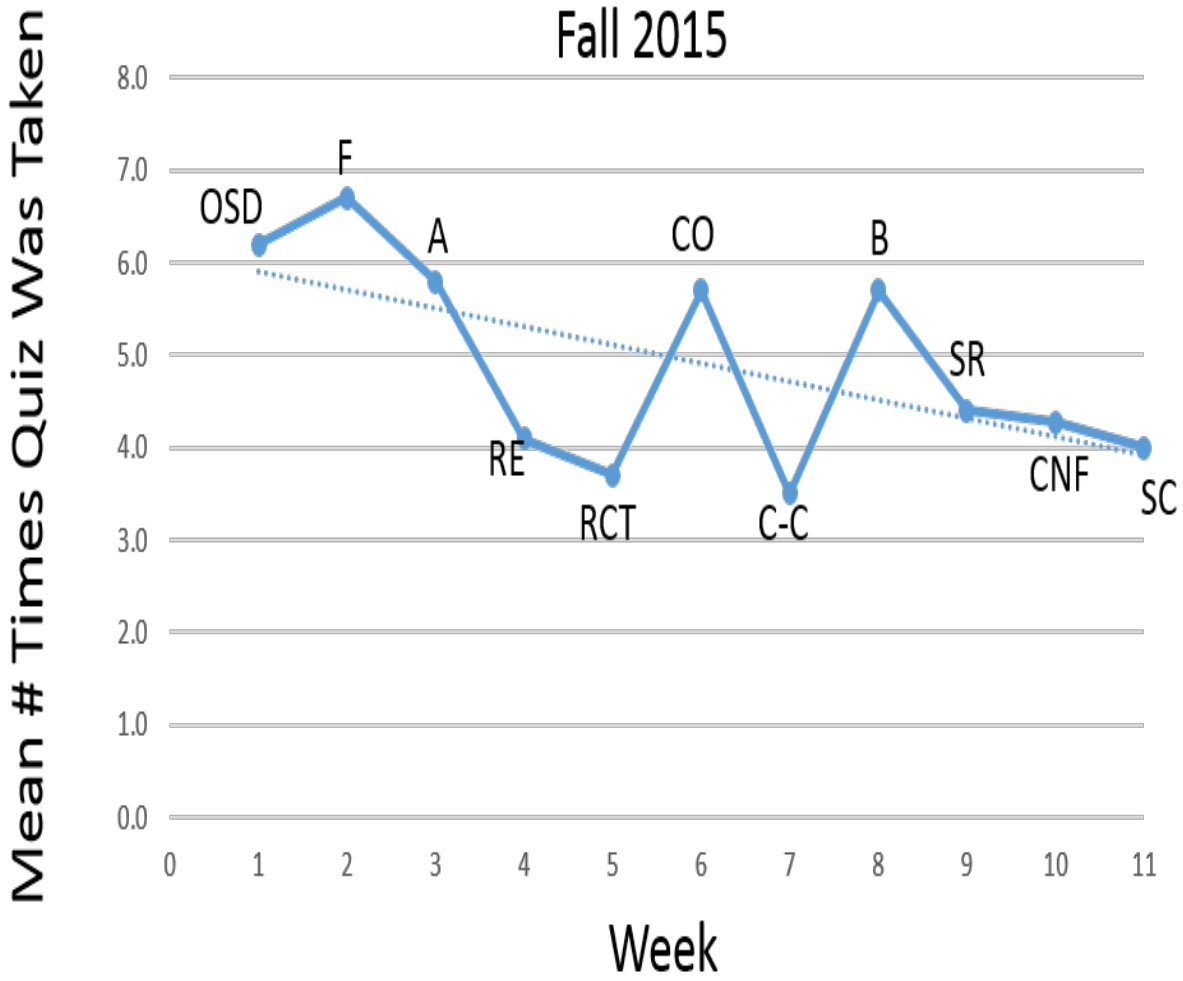

#10 Confounding & EMM - Fall 2015
% of Students
Median: 4; Mean: 4.3
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken

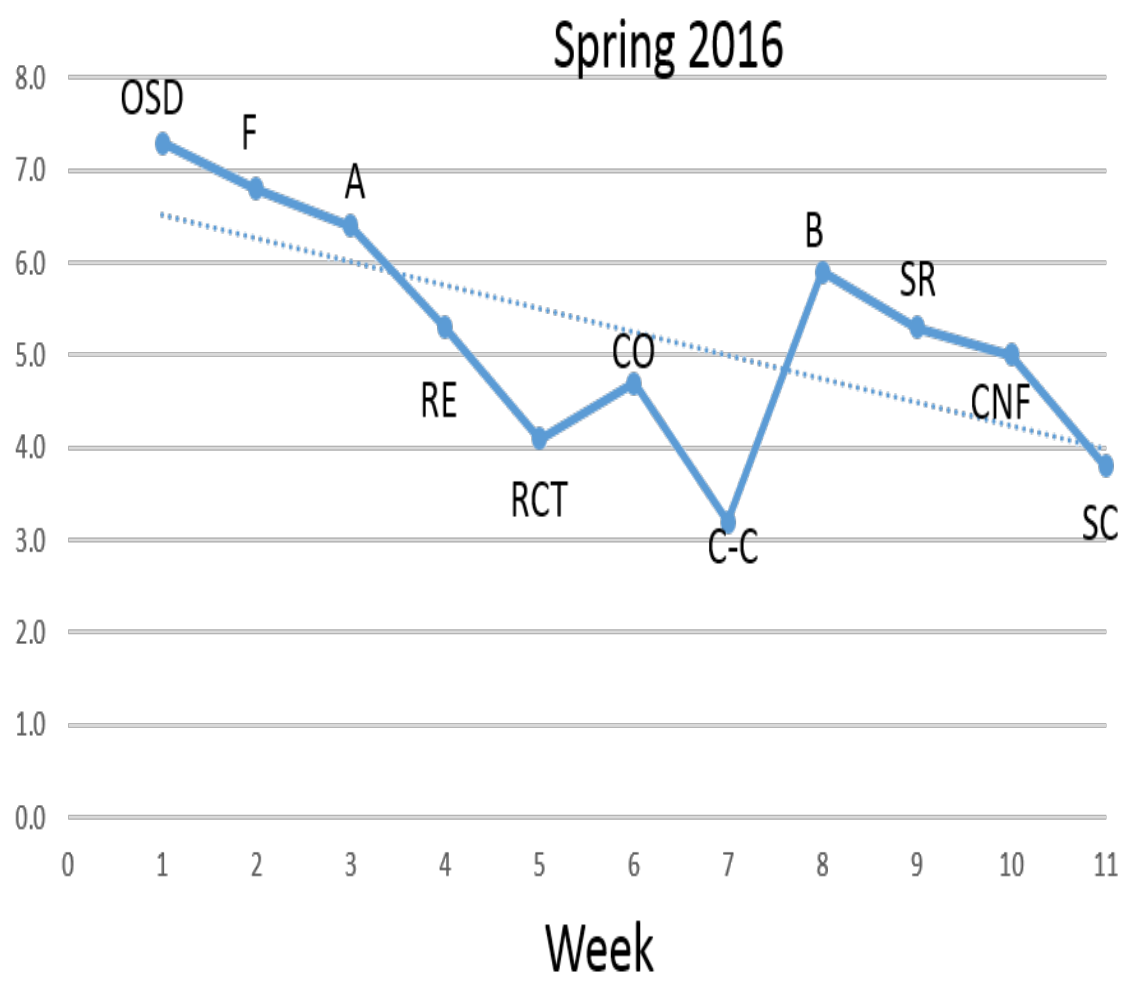

#10 Confounding & EMM - Spring 2016
Median: 5; Mean: 5.5
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15
Times Quiz Taken


#11 Screening- Fall 2015
% of Students
Median: 3; Mean: 4.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15


#11 Screening - Spring 2016
Median: 3; Mean: 3.8
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 >15

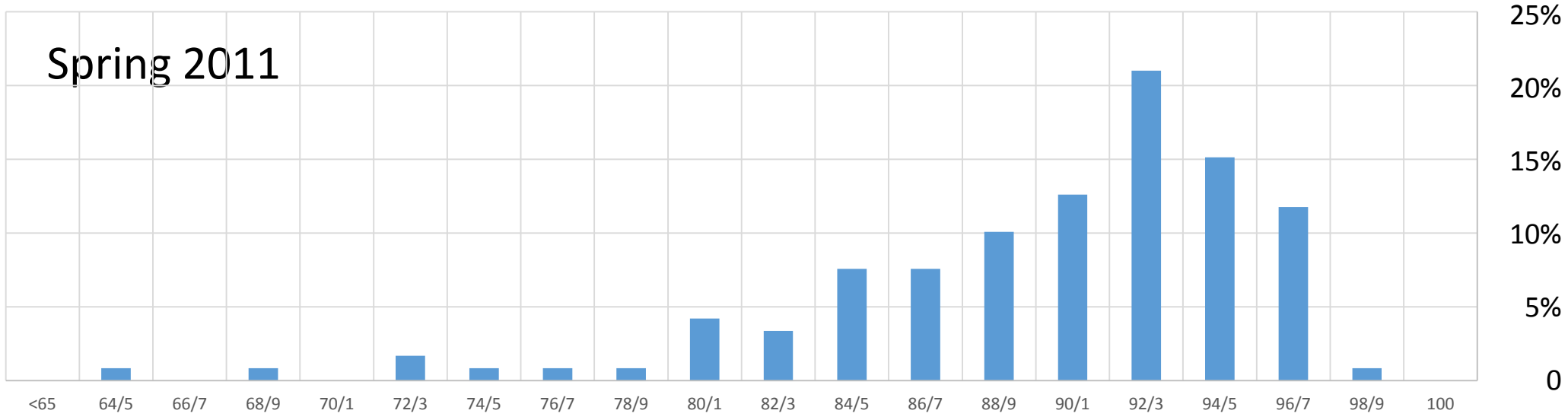
Change in Quiz Taking Frequency Over Time

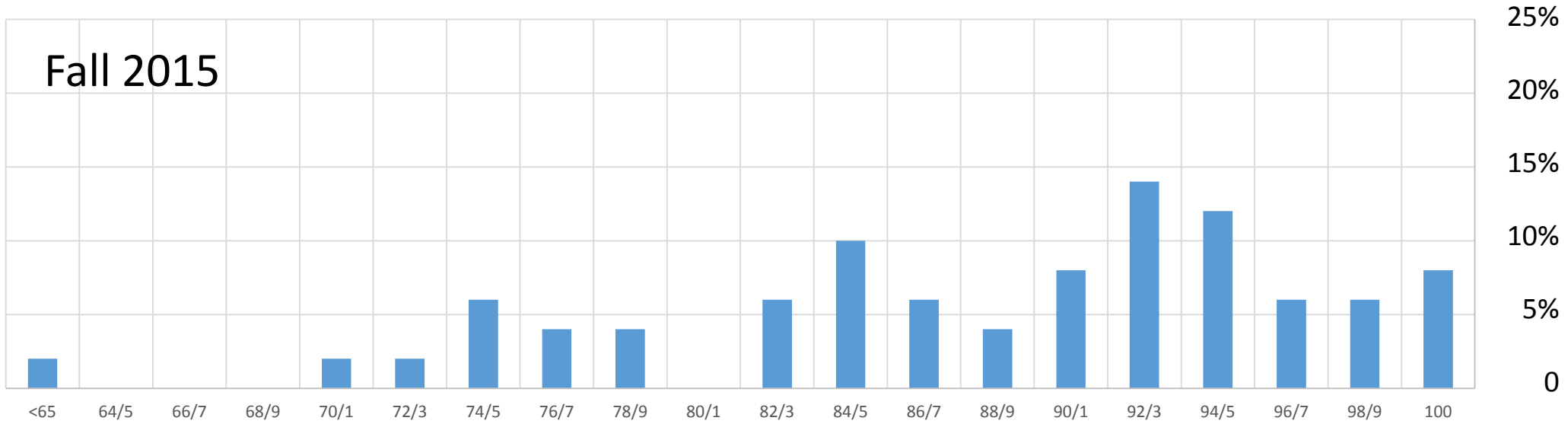




- Varying difficulty among quizzes
- Growing confidence and understanding of concepts over time
- Probably *not* complacency or fatigue over the semester (achieved scores remained high

Final Exam Grade Distributions





Conclusions

Students universally liked this format, but the distribution of final exam scores was not significantly different from previous semesters.

<u>Study Limitations</u>: Lack of a valid comparison group & confounding factors

- Increased rigor of the exams
- Variability in quality/experience of students year to year

Can't say learning was better or longer lasting, but students were motivated to work harder & engage in *<u>active learning</u>*, doing problem sets 4-7 times.