

Proficiency-based Assessment
and Reassessment of Learning
Objectives (PARLO):
An Evidence-based Research
Experiment

Joint Statistics Meetings

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Current Practice

- A typical classroom...
 - Students listen to us lecture
 - We ask “Do you understand?”
 - They sheepishly nod
 - We move on...
- Give exams and grade them
- Pros: Limited preparation time (we still get our paycheck)
- Cons: Limited student learning

Background - YWLCS

- Inspired by *Young Women's Leadership Charter School of Chicago* (www.ywlcs.org)
 - Learning Objectives by Course, No Time Restrictions
 - Grade advancement
 - Proficient in 70% of objectives to become sophomore
 - Proficient in 75% of objectives to become junior
 - Proficient in 80% of objectives to become senior
 - Proficient in 85% of all objectives to graduate
 - Success
 - Highest grad rate of non-selective public schools
 - >95% of graduates admitted to college
 - >85% of initial cohort still in college in 2005-2006

Main Question

What are the
impacts on student attitudes
and performance
of offering
proficiency grading
and assignment resubmission?

Methods

- Two sections of intro statistics (for non-majors)
 - Same instructor, same material
 - Back-to-back class times (1:30 / 3 pm on Mon & Wed)
 - Data gathered over two years
 - Treatment order switched
- Two groups
 - Control group (Numeric grading)
 - Weekly HWs, 2 midterm exams
 - PARLO group (Proficiency grading and Assignment resubmission)
 - Weekly HWs, weekly quizzes (yr 1), 2 midterm exams (yr 2)
- Main Outcome – Common Final Exam
 - Additional Outcomes
 - Attitude Surveys
 - Course Evaluations

Proficiency Grading

- Evaluated on each of 19 course objectives (given to both groups)
 - *Examples:*
 - *Identify types of variables*
 - *Summarize quantitative data with stem-and-leaf plots, histograms*
 - *Calculate and interpret linear regression equation*
 - *Use the z-table to calculate percentile for standard normal distribution*
- Three-tiered proficiency-grading system
 - Master (M) – (almost) flawless
 - Proficient (P) – grasped major concepts
 - Developing (D) – minimal understanding
 - Not Submitted (N)

Assignment Resubmission

- Students could resubmit to improve proficiency rating
- Resubmission structure
 - HWs
 - Due one week after assignments returned
 - Same problem(s)
 - Quizzes (Year 1 only)
 - Retake one week after quizzes returned
 - New problem(s)

Results - Course Evaluations

- Course Evaluations were comparable between groups except for...

“Grades Student Work Fairly”

	Strongly Agree 5	4	Neutral 3	2	Strongly Disagree 1
Control	40% (17)	33% (14)	19% (8)	9% (4)	0
PARLO	60% (31)	25% (13)	12% (6)	4% (2)	0

Averages = 4.00 (Control) and 4.45 (PARLO)

P-value =0.02 from Jonckheere-Terpstra Nonparametric test for Ordinal Trend

Result – Attitudes – Year 1

- Differential changes in pre/post questions (5 point scale)

Question	PARLO	Control	P (2st) ¹	P (J-T) ²
“I dislike algebra”	-0.5	+0.25	0.02	0.02
“expect to do well in math courses”	+0.27	-0.15	0.05	0.03

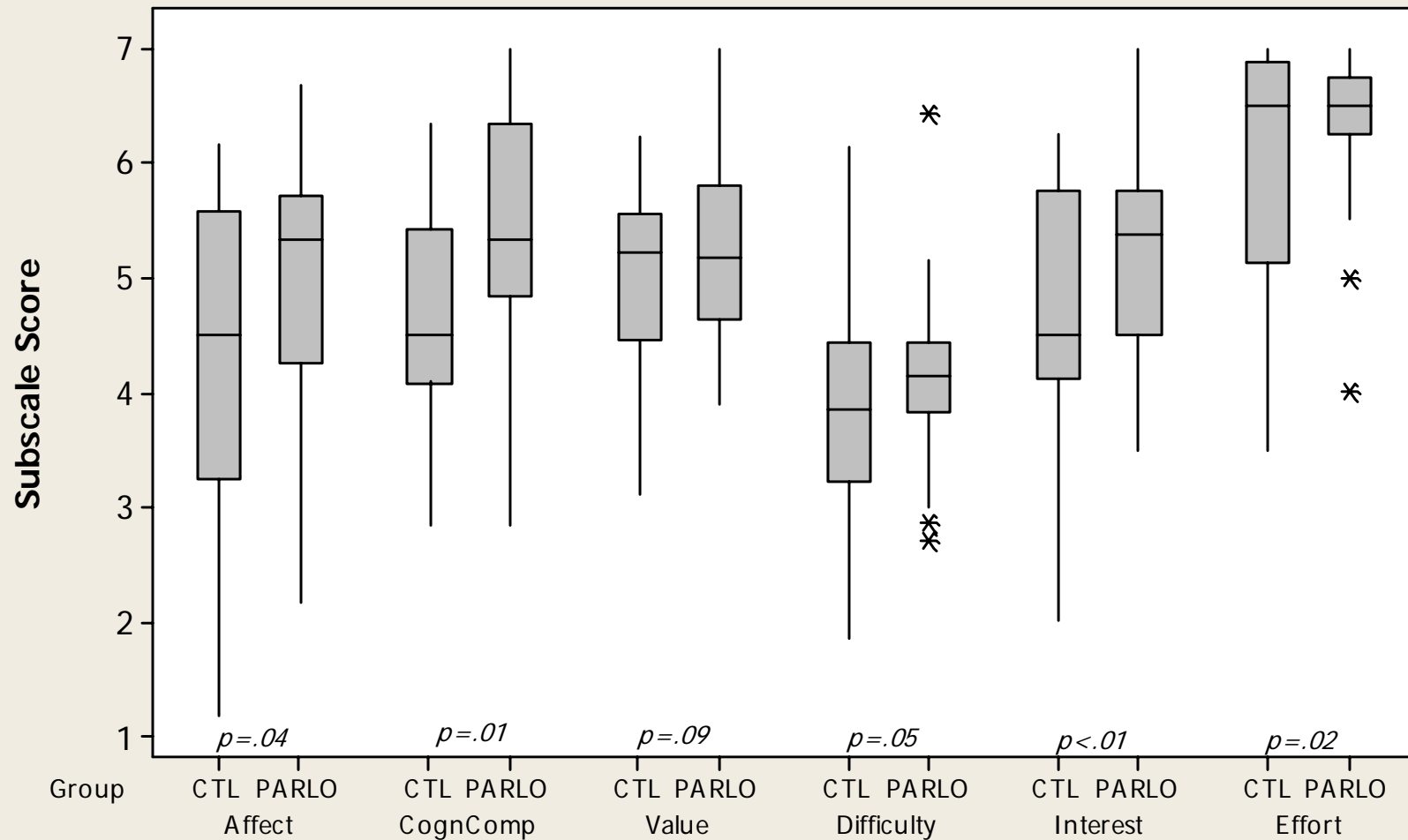
¹ two-sample t-test

² Jonckheere-Terpstra (non-parametric ordinal test)

- PARLO group more satisfied that they could work at own pace, 96% v. 75% (p=0.07)
- 92% (24 of 26) in PARLO group strongly satisfied with the new grading system (1 mod, 1 no ans)

Result – Attitudes – Year 2

Boxplot of Attitude Subscales (Post Only)



I like stats

I understand stats

Stats is important

Stats is hard

Interested in stats

Will work/worked hard

Results – Final Exam

For both years of data combined...

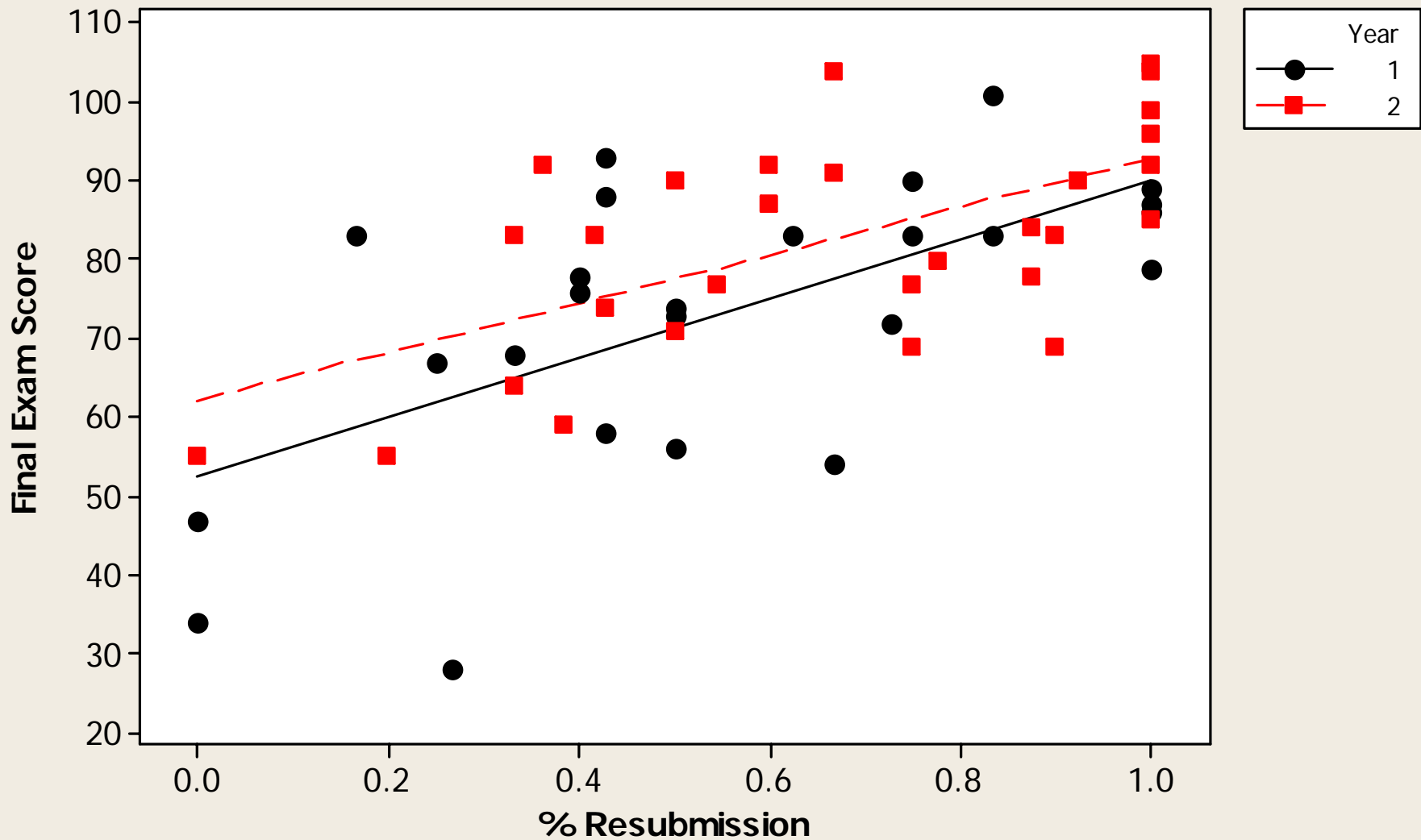
	PARLO	Control	P-value
Mean	79	83	0.18
Median	83	86	0.16

Results differed somewhat by math ability
(4 point increase for “low SAT (< 580)”)

Results - Resubmission (PARLO)

- Percent resubmission
 - # resub / # potential resubs
- Percent resub for increase (Year 2 only)
 - # resub for increase / # potential resubs
- Delayed proficiency
 - Only became proficient on second try
 - (# of D->P, D->M, or P->M) / (# P or M)

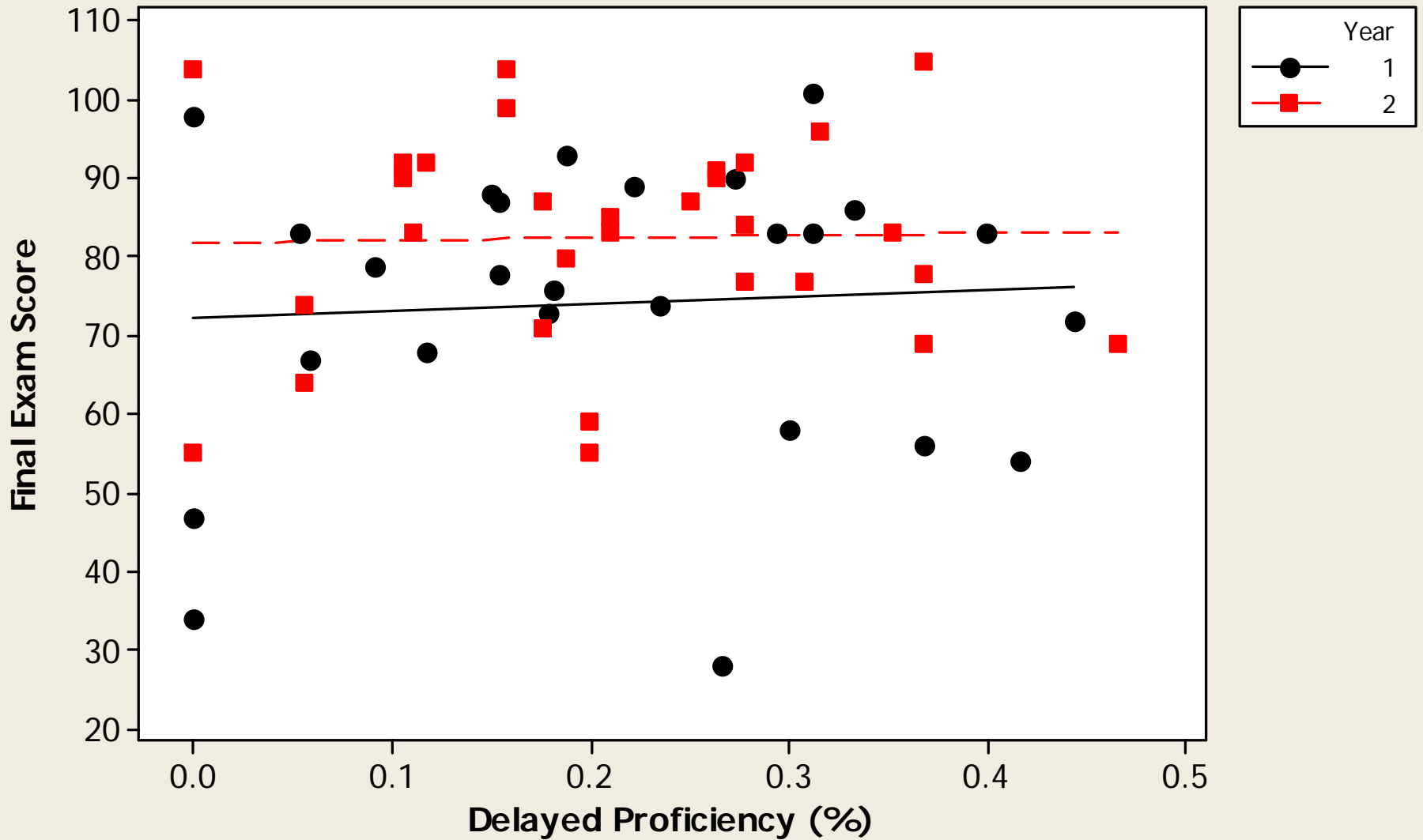
Final Exam Score by % Resubmission



Final Exam = 56 + 36 %resub ($p < 0.001$)

Similar Results with no Ns ($n=1$) -> 100% and weighted by denom

Final Exam Score by Delayed Proficiency (%)



No relationship ($p=0.74$ / 0.96 weighted by denom)

Summary

- Mutiny didn't occur!
- Students who resubmitted did better
 - Due to engaging with material?
 - Due to self-selection bias/type of student?
 - Controlling for MathSAT, %resub still significant (30% less)
- Achieving proficiency on first or second attempt produced similar results on final exam
- No difference on final exam
 - possible improvement for low math ability students
- Evaluation on course objectives allows students and instructor to better assess learning

Change is Hard!

If you would attain to what you are not yet, you must always be displeased by what you are. For where you are pleased with yourself there you have remained. Keep adding, keep walking, keep advancing.

~Saint Augustine

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