

Objective

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

Inspiration/Model

Young Women's Leadership Charter School of Chicago (www.ywllcs.org)

- Opened in 2000
- Highest graduation rate of non-selective schools
- 100% of class of 2005 attending college

Experimental Design

- Two sections of introductory statistics (for non-majors)
- Same instructor, same material, back-to-back class periods
- First year students are somewhat randomized
- Control Group
 - Numeric Grading
 - Weekly homework, 2 exams, final exam
- Experimental Group
 - Proficiency Grading
 - Assignment Resubmission
 - Weekly homework and quizzes, final exam

Learning Objectives

- 19 learning objectives defined. Examples include:
 - Summarize quantitative data with stem-and-leaf plots, histograms
 - Calculate and interpret linear regression equation
 - Use the z-table to calculate percentiles for standard normal distribution
- Used to clarify course goals
- Used by students to identify problem areas
- Used by instructor in assessment design

Proficiency Grading

Three tiered proficiency-grading system

- Not proficient (NP) – minimal understanding
- Proficient (P) – grasped major concepts
- High Performance (HP) – (almost) flawless

Assignment Resubmission

- Students not achieving proficiency ("NP") could resubmit
 - HW: same problem, due one week later
 - Quizzes: new problem, taken one week later

Results

Class Summary

	Exper	Control
Total n	26	21
Drop	0	1
Analytic n	26	20
Females	67%	65%
White	65%	75%
1 st year	50%	70%
Arts Major	88%	80%

Course Evaluations

Experimental group said (on a 5 point scale):

- Goals of course were clearer (4.91 vs. 4.71)
- Better interaction with students (4.87 vs. 4.56)
- Respects students' views (5.00 vs. 4.78)
- More fair grading (4.57 vs. 4.00)
(Note: students in control did better!)
- Requires harder work (4.13 vs. 3.88)
- Learned more (4.13 vs. 3.67)
- **WORSE** at explaining material (4.48 vs. 4.72)

Course Surveys

Question	Exper	Control	Diff
"I dislike algebra"	-0.5	+0.25	-0.75
"expect to do well in math courses"	+0.27	-0.15	+0.42

- Differences produce $p < 0.05$ for two-sample t and Jonckheere-Terpstra (ordinal nonparam test)
- Experimental group more satisfied that they could work at own pace, 96% v. 75% ($p = 0.07$)
- 92% (24 of 26) in experimental group strongly satisfied with the new grading system (1 mod, 1 no ans)

Summary

- Mutiny didn't occur (whew!)
- Students who resubmitted did better
 - Due to engaging with material?
 - Due to self-selection bias/type of student?
- Achieving proficiency on first or second attempt produced similar results on final exam
- Experimental group didn't perform better on final exam but the low math ability students did show an improvement
- Evaluation on course objectives allows students and instructor to better assess learning

Final Exam Summary

	Exper	Control	Diff	p-value
Mean	74.2	83.4	-9.2	0.12
Median	78.5	88.5	-10.0	0.04

...but They Differed by Math Ability

	Exper	Control	p-value
HS Math GPA	3.07	3.42	0.02
Math SAT	612	645	0.11

- Controlling for math ability, experimental group scored 2 point lower (not signif)

Effect by Ability

Math Ability	High	Mod	Low
HS Math GPA	>3.5		<3.0
Math SAT	>670		<590
Exper Effect	-11.3	+1.0	+7.3

A Parting Quote...

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.

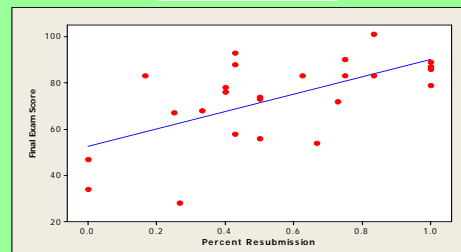
~Saint Augustine

Results – Effects of Resubmission and “Delayed” Proficiency

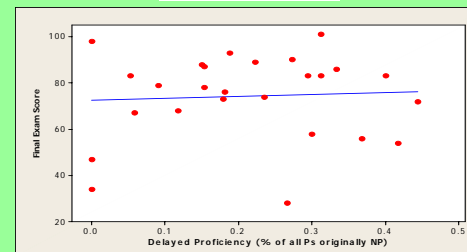
Percent resubmission:
% of all NPs resubmitted
 $N2P / (NP + N2P)$

NP = Not Proficient
P = Proficient
 $N2P = \text{Proficient on 2}^{\text{nd}}$ attempt

Delayed proficiency:
% of all Ps originally NP
 $N2P / (N2P + P)$



Final Exam = 52 + 39 %resub ($p = 0.003$) no Ns ($n = 1$) -> 100%
Final Exam = 53 + 38 %resub ($p = 0.001$) no Ns excluded
Final Exam = 44 + 46 %resub ($p = 0.001$) weighted by $N + N2P$
Summary – the more you resubmit, the better your grade is



No relationship ($p = 0.77$ / 0.96 weighted by TotP)
Summary – Doesn't matter how you achieved proficiency, same net effect

Contact Information

Michael A. Posner, Ph.D.
Assistant Professor of Statistics
Department of Mathematical Sciences
Villanova University
michael.posner@villanova.edu
610-519-3016

Funding for this project was provided by
The Math Science Partnership of Greater Philadelphia
through a grant from
The National Science Foundation