Comparing Instructor Created vs. Externally Created Homework Assignments And Their Effects On Exam Scores

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Survey Analysis

- In addition to the model analysis on exam scores, we administered a survey in order to assess three unmeasurable attributes: the students' perceived understanding of the material, their interest in studying the material through the homework assignments, and their overall engagement (measured primarily as how much they cared for pursuing their desired grades).

- Survey was 12 items long
- 4 items for each attribute
- Used reverse coding and redundant wording to maintain internal consistency
- Cronbach alphas showed that the questions were internally consistent, so we were able to average them into one overall score for each attribute
- Administered electronically after the first and second exam each semester, by paper after the final
- The survey was updated between the first and second exams of the Spring 2018 semester, so exam 1 results are not reported for that semester

			PCH		ICH	
		Cronbach Alpha	Mean	Median	Mean	Median
S18 Exam 2	Understanding	0.738	0.2024	0.25	0.2285	0.50
	Interest	0.693	-0.0516	0.00	-0.0385	0.00
	Engagement	0.734	1.1264	1.25	1.1516	1.25
S18 Final	Understanding	0.828	0.5013	0.75	0.2028	0.25
	Interest	0.735	0.0905	0.25	-0.1135	0.00
	Engagement	0.792	1.1809	1.25	1.0301	1.00
F18 Exam 1	Understanding	0.774	0.2654	0.25	0.2324	0.5
	Interest	0.723	0.2315	0.25	0.1514	0.25
	Engagement	0.742	1.4691	1.5	1.4311	1.5
F18 Exam 2	Understanding	0.76	0.3852	0.5	0.2421	0.25
	Interest	0.731	0.1168	0.125	0.0491	0
	Engagement	0.805	1.3893	1.5	1.2073	1.25
F18 Final	Understanding	0.818	0.3957	0.5	0.4292	0.75
	Interest	0.696	0.1482	0.25	0.2052	0.5
	Engagement	0.825	1.2374	1.5	1.2465	1.5

References

- Cronbach, L.J. Psychometrika (1951) 16(3). https://pdfs.semanticscholar.org/e985/ac2e151903000cac310ffbc5b2cb4fbb9dd5.pdf
- Falisard, Bruno (2012). psy: Various procedures used in psychometry. R package version 1.1. https://CRAN.R-project.org/package=psy
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Introduction

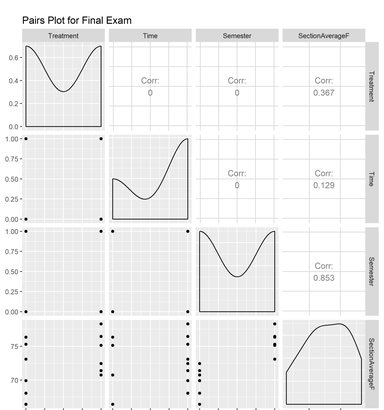
This study was motivated by the number of course evaluations and student comments to instructors and teaching assistants saying the homework they completed throughout the semester did not resemble what they saw on the exams. We already used our university's learning management software, Canvas, to administer small assessments and surveys, so we theorized it might be possible to create and administer entire homework assignments through Canvas.

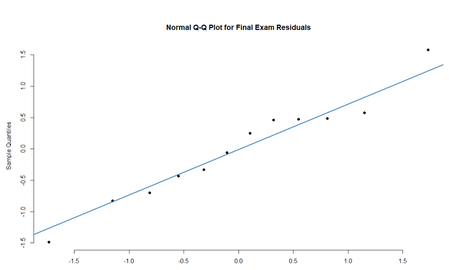
The model we used seeks to test whether the sections completing the instructor-created homework assignments (ICH) had higher average exam scores than the sections completing the publisher-created homework assignments (PCH).

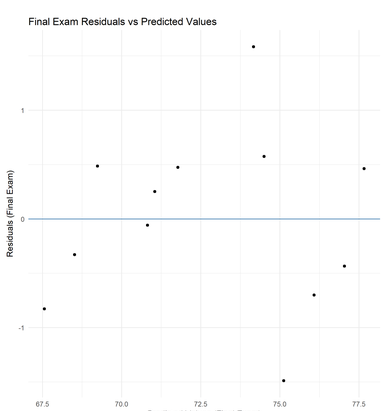
- 2 Semesters of data **(Blocking variable)**
- 6 Sections of STA 261 each semester
- 3 Instructors total, one taught 6 sections, the others each taught 3 **(Random effect)**
- Half of the sections were randomly assigned to complete instructor-created ICH assignments through Canvas, the remainder completed PCH assignments through Pearson's MyStatLab **(Treatment)**
- Historical evidence shows the sections that have class throughout the middle of the day (10 AM – 4 PM) generally perform better than the sections that meet during the extreme times (8 AM and 4 PM) due to honors status and undesirable enrollment times **(Blocking variable)**
- Ran the model 3 times, once for each of the 2 midterms, and once for the final

		Exam		
		Exam 1	Exam 2	Final Exam
Parameter Estimate	Treatment (ICH–PCH)	1.7754	1.9196	2.5365
	Time (Inner-Outer)	1.7859	0.78	0.9558
	Semester (Fall-Spring)	-5.826	0.8937	5.884
	Instructor (Variance)	0.1883	1.797e-14	0.4207

Model Diagnostic Plots for Final Exam







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Results and Discussion

Parameter estimates for the treatment effect (ICH assignments – PCH assignments), as well as t-statistics and standard errors can be found in the table below.

	Exam 1	Exam 2	Final Exam
Estimated Difference	1.7754	1.9196	2.5365
T-Statistic	2.00	2.48	3.16
Standard Error	0.8874	0.7735	0.8017

We did not feel it was appropriate to run a formal t-test and find a p-value for each difference, as they were not provided by the lmer package in R, and their calculation would be non-trivial due to the nature of the mixed effects model. All three estimated differences are at least two standard errors away from 0 in favor of the ICH assignments, so the results are promising.

Pros of ICH

- Eliminates the cost of purchasing access to publisher created platforms (would save approximately $60,000 at our university each semester)
- Writing on homework is more consistent with writing on exams since our instructors create both

Cons of ICH

- Large time commitment initially building the assignments
- Minor technical issues throughout the semester, but no more than using an externally created homework platform
- Canvas cannot generate random values, would need to add new variations of problems over time
- Could not easily create multiple part problems in Canvas as separate questions while maintaining multiple versions
  - Lead to some 10-15 part questions on inferential procedures
  - Students could not get feedback for each part, unlike in the PCH
  - Canvas was not clear which parts of student answers were incorrect
  - Can be seen as a pro since students had to engage with the material and go over it with instructors more thoroughly