Comparing assessment data between LA and TA supported studios

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Background

Teaching Assistant (TA)

- Graduate Student or upper level undergraduate
- No formal teaching training

Learning Assistant (LA)

- Undergraduate student who had previously taken the course
- Took a pedagogy course

Data Collection (No LAs) → Transformation & LAs → Data Collection (LAs)

Otero, V., Pollock, S., & Finkelstein, N. "A Physics Department's Role in Preparing Physics Teachers: The Colorado Learning Assistant Model." American Journal of Physics 78, 1218 (2010); https://doi.org/10.1119/1.3471291

Otero, V. "The learning assistant model for teacher education in science and technology." In Forum on Education of the American Physical Society (Vol. 31). (2006).

Close, E., et al. "Characterization of time scale for detecting impacts of reforms in an undergraduate physics program." Physics Education Research Conference (2017).

Engineering Physics Courses at Kansas State University
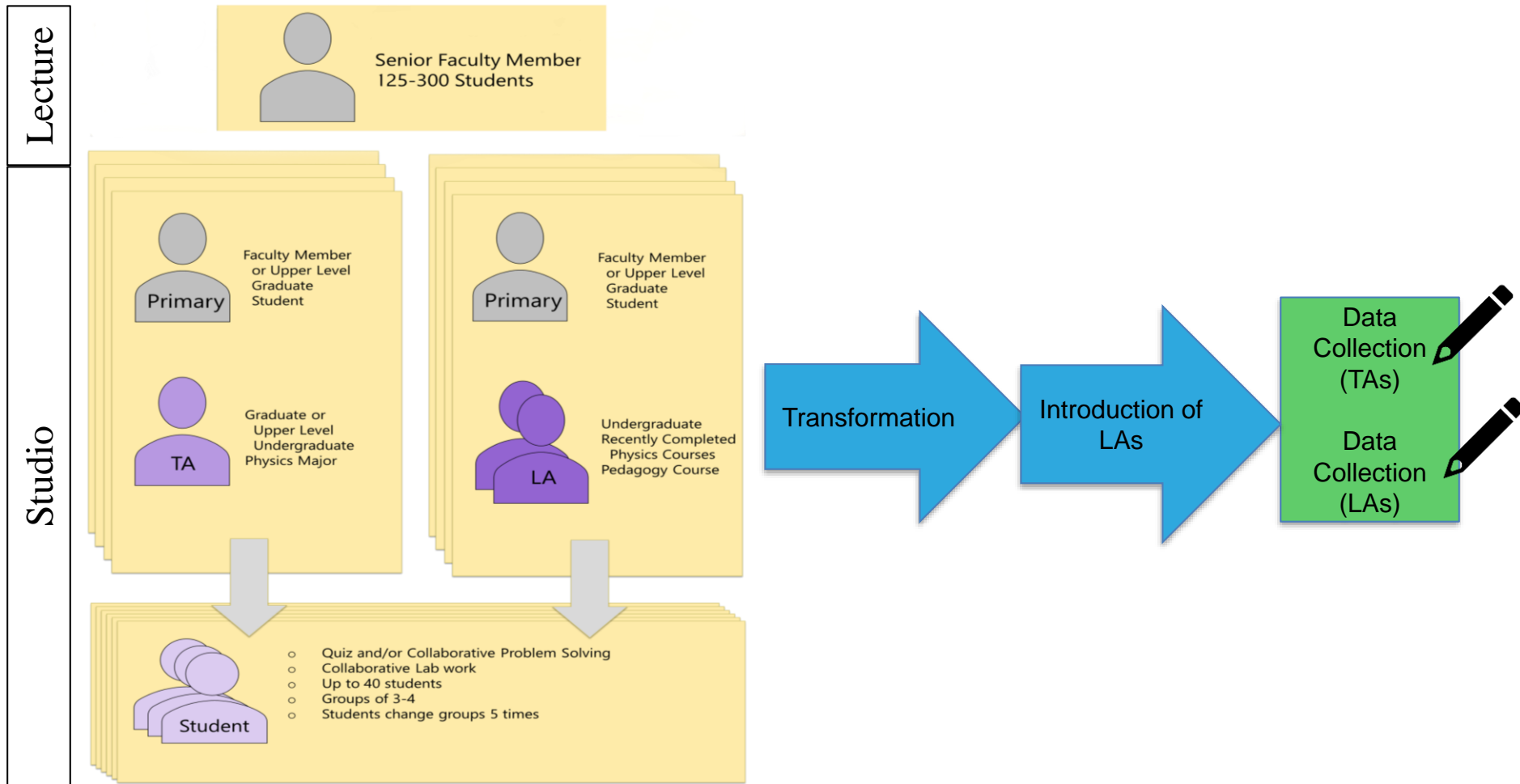
Assessments

Measurements

Force Concept Inventory (FCI)

    3 semesters

The Colorado Learning Attitudes about Science Survey (CLASS)

    3 semesters

Brief Electricity and Magnetism Assessment (BEMA)

    1 semester

Post Score

Gain = Post-Pre

D. Hestenes, M. Wells, and G. Swackhamer, "Force concept inventory." Phys. Teach. 30 (3), 141 (1992).

Adams, Wendy K., et al. "New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. Physical review special topics-physics education research 2.1 (2006): Phys. Rev. ST Phys. Educ. Res. 2, 010101

Ding, Lin, et al. "Evaluating an electricity and magnetism assessment tool: Brief electricity and magnetism assessment." Physical review special Topics-Physics education research 2.1 (2006): Phys. Rev. ST Phys. Educ. Res. 2, 010105.

Comparing Means

Tukey's HSD

$$T_\alpha = \frac{q_\alpha(a,f)}{\sqrt{2}} \sqrt{MS_E \left(\frac{1}{n_{LA\ students}} + \frac{1}{n_{TA\ students}} \right)}$$

If the difference between two sample means is less than the above value, they are not significantly different.

Cohen's d

$$d = \frac{M_{LA} - M_{TA}}{\sqrt{(s_{LA}^2 + s_{TA}^2)/2}}$$

d can be thought of as representing how much two distributions overlap. When $d = 0$, then both distributions completely overlap.

d	Effect Size	% Overlap
0.2	Small	85.3
0.5	Medium	67.0
0.8	Large	52.6

Cohen, Jacob. "Statistical power analysis for the behavioral sciences. 2nd." (1988).
Becker, Lee A. "Effect Size." (2000). https://www.uccs.edu/lbecker/effect-size#1.%20Standardized%20difference%20between%20two
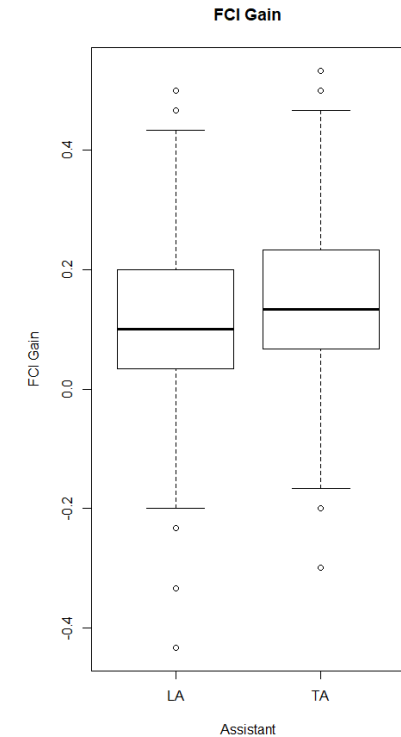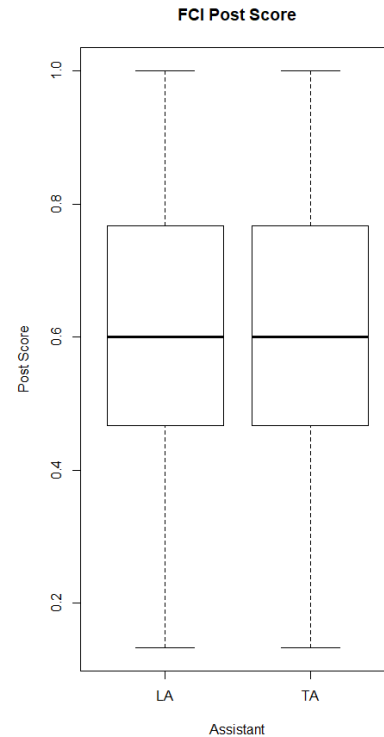Montgomery, Douglas C. "Design and analysis of experiments. 8th." (2013).

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Force Concept Inventory (FCI)

Students by Semester

	A	B	C	Total
LA	110	63	218	391
TA	199	65	96	360
Total	309	128	314	751

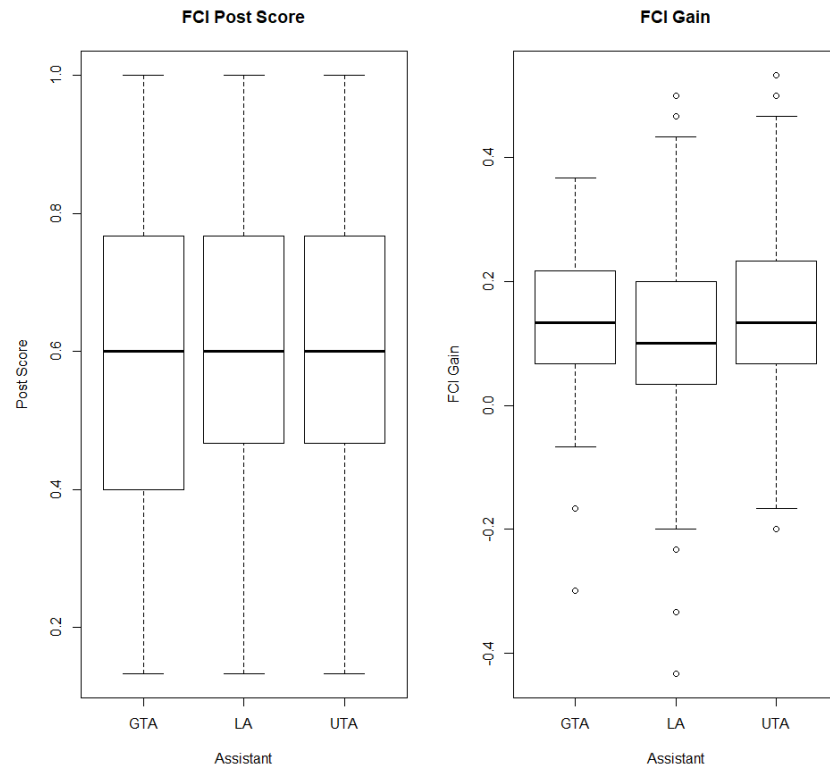|	Post Average	Gain Average
LA	60.71 %	12.07 %
TA	61.15 %	13.96 %
T_α	1.83 %	1.83 %
d	0.02	0.14

FCI Post Score

FCI Gain

D. Hestenes, M. Wells, and G. Swackhamer, Force concept inventory, Phys. Teach. **30** (3), 141 (1992).

Force Concept Inventory (FCI)

Students by Semester

	A	B	C	Total
GTA	79	0	0	79
LA	110	63	218	391
UTA	120	65	96	281
Total	309	128	314	751

|	Post Average	Gain Average
GTA	60.04 %	12.70 %
LA	60.71 %	12.07 %
UTA	61.46 %	14.31 %
T_α	3.34 %	3.34 %

D. Hestenes, M. Wells, and G. Swackhamer, Force concept inventory, Phys. Teach. **30** (3), 141 (1992).

The Colorado Learning Attitudes about Science Survey (CLASS)

Students by Semester				
	A	B	C	Total
LA	111	52	191	360
TA	209	62	83	348
Total	320	114	274	708

	Post Average	Gain Average
LA	57.59 %	-6.17 %
TA	61.38 %	-2.96 %
T_α	2.00 %	2.00 %
d	0.21	0.22
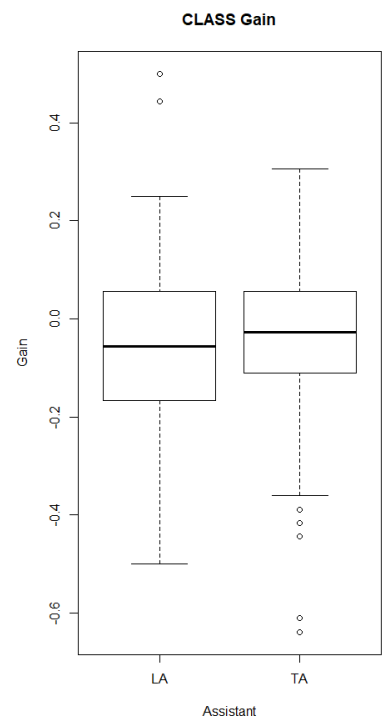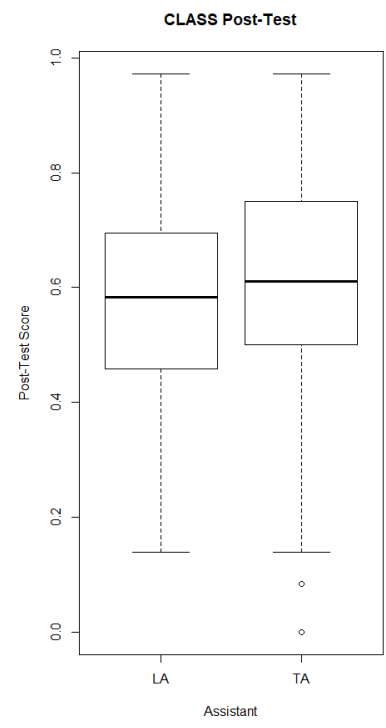
Adams, Wendy K., et al. "New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey." *Physical review special topics-physics education research* 2.1 (2006): 010101.

The Colorado Learning Attitudes about Science Survey (CLASS)

Students by Semester

	A	B	C	Total
GTA	95	0	0	95
LA	111	52	191	355
UTA	114	62	83	253
Total	320	114	274	708

	Post Average	Gain Average
GTA	59.68 %	-4.30 %
LA	57.59 %	-6.17 %
UTA	62.02 %	-2.47 %
T_α	3.41 %	3.42 %

Adams, Wendy K., et al. "New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey." *Physical review special topics-physics education research* 2.1 (2006): 010101.
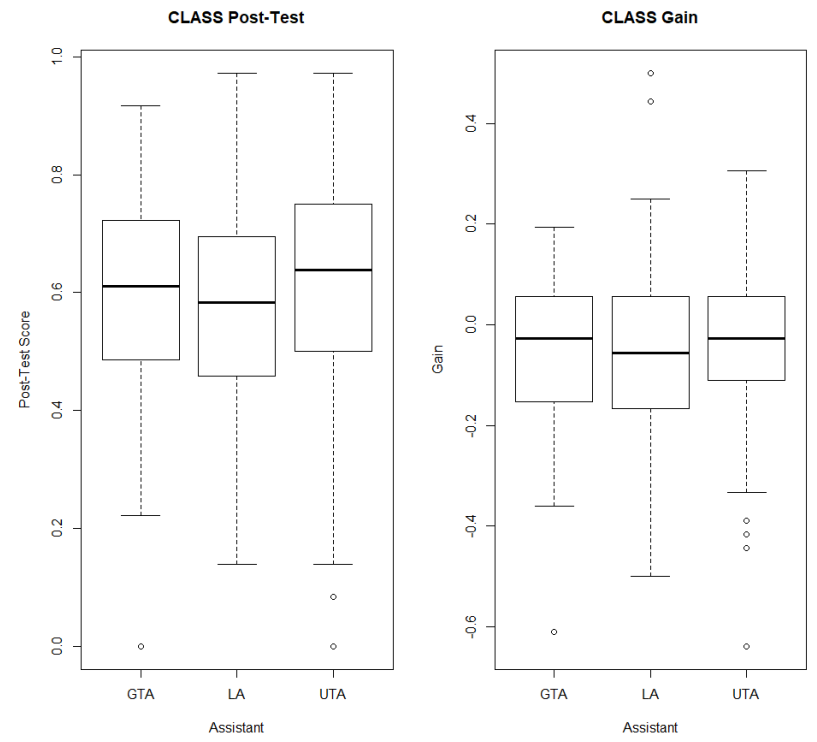
Brief Electricity and Magnetism Assessment (BEMA)

	Students	Post-Test	Gain
GTA	100	33.54 %	7.81 %
LA	121	33.17 %	8.02 %
UTA	46	33.00 %	6.31 %
Total	267	33.27 %	7.65 %

Possible reasons for this result:

Prior results could be due to other course transformations.

The LA pedagogy course may not affect **these** assessment results.

Post-assessments were administered at the end of the semester rather than right after Newton's Laws section for the FCI.

We are **not** claiming that TAs and LAs are the same, only that the results are the same for these measures.

Impacts of the LA program on LAs are not accounted for.

This project does not look at how students view LAs and TAs.

Ding, Lin, et al. "Evaluating an electricity and magnetism assessment tool: Brief electricity and magnetism assessment." Physical review special Topics-Physics education research 2.1 (2006): Phys. Rev. ST Phys. Educ. Res. 2, 010105.

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