The impact of infusing interaction and visualization into introductory physics subjects

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Participation

	Non-interactive	Interactive
Initial	~ 150	~ 150
Final	30	17

Post-test differences

	Non-interactive	Interactive
Initial	11.8	12.3
Final	3.8	2.1

P-value: 0.65

Pre-test differences

	Non-interactive	Interactive
Mean	9.7	10.5
StDv	3.1	2.1

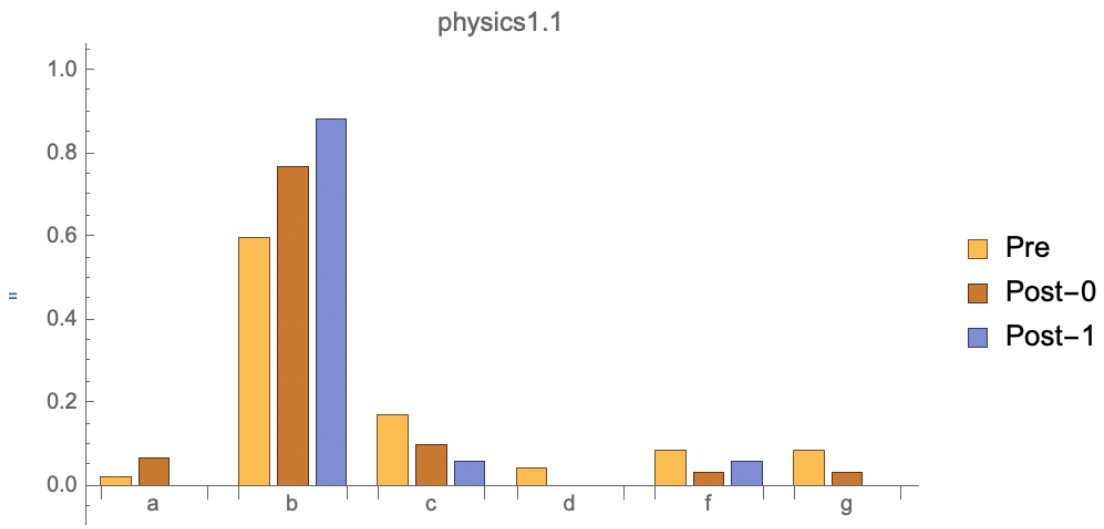
P-value: 0.34

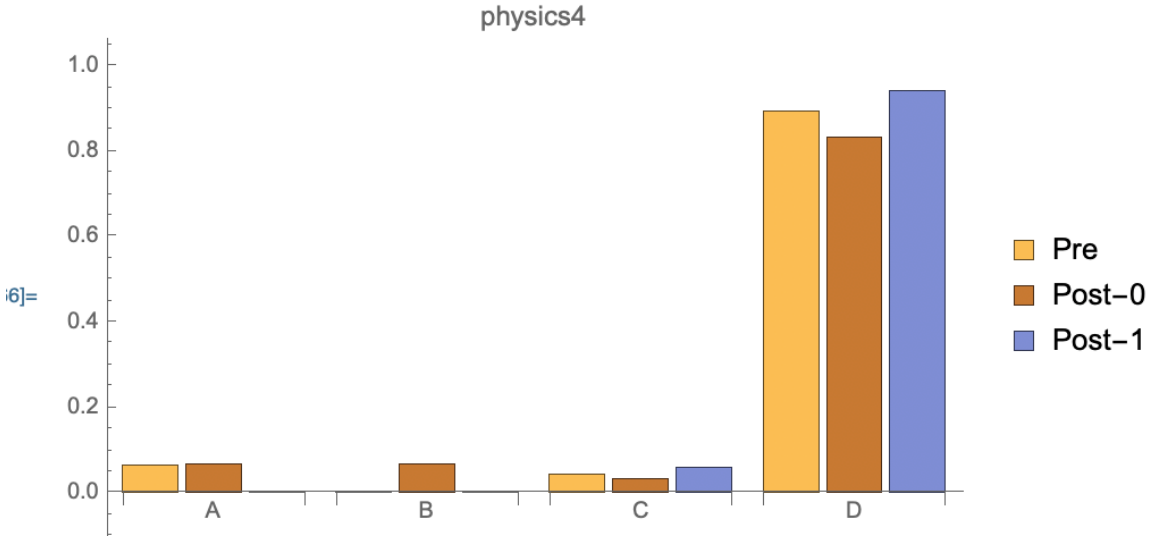
Improvement differences

	Non-interactive	Interactive
Initial	2.1	1.7
Final	4.3	2.2

P-value: 0.75

Examples of results by pre-/post-test question





Our cohorting algorithm – theory and future work

The cohorting tool

- Provides better-than-random assignment of incoming students to different treatment groups.
  - Preserves the statistical benefits of randomness, allowing for standard statistical analysis
  - Balances the distribution of covariates across treatment groups.
- For example this can prevent imbalances of incoming skills across treatment groups
- The theory for these quasi-randomization techniques were first developed for use in clinical trials, when randomization needed to be applied as patients arrived, not all at once

Impact and publication

- The code we developed for this purpose is being made available to other educational researches for use in their experiments
- We are currently preparing a paper on the development and use of this tool for publication, and are targeting journals in educational research methodology

Adaptive vs Random assignments

Average standardized mean differences (SMD) before and after attrition (lower is better)

Before Attrition

	WL	Lang	Complete	Hours	Support	Physics	Consc
Algorithmic	0.084	0.147	0.189	0.329	0.055	0.022	0.192
Random	0.154	0.300	0.314	0.484	0.152	0.138	0.154

After Attrition

	WL	Lang	Complete	Hours	Support	Physics	Consc
Algorithmic	0.271	0.631	0.686	1.125	0.630	0.245	0.246
Random	0.386	0.711	0.721	1.182	0.392	0.368	0.372