

Evaluating the effectiveness of two methods to improve students' problem solving performance after studying an online tutorial

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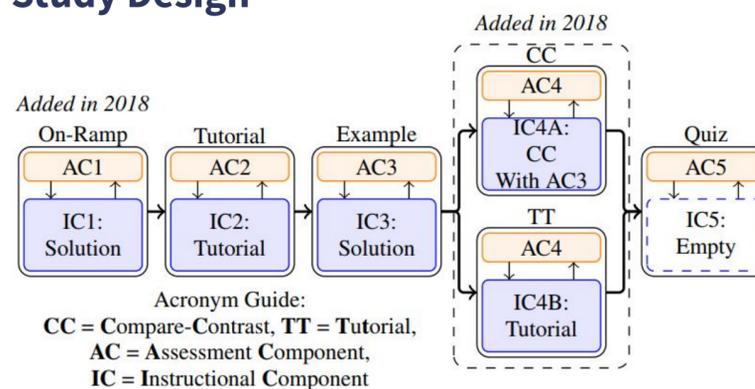
Main Points

- We tested two strategies for improving student performance on subsequent similar problems following an online tutorial.
- A compare-contrast activity did not improve student performance over a tutorial.
- An on-ramp activity improved student performance compared to a previous, unaffected cohort.
- In one of two sequences, the improvements occurred among students who spent sufficient time on the problems.

Research Questions

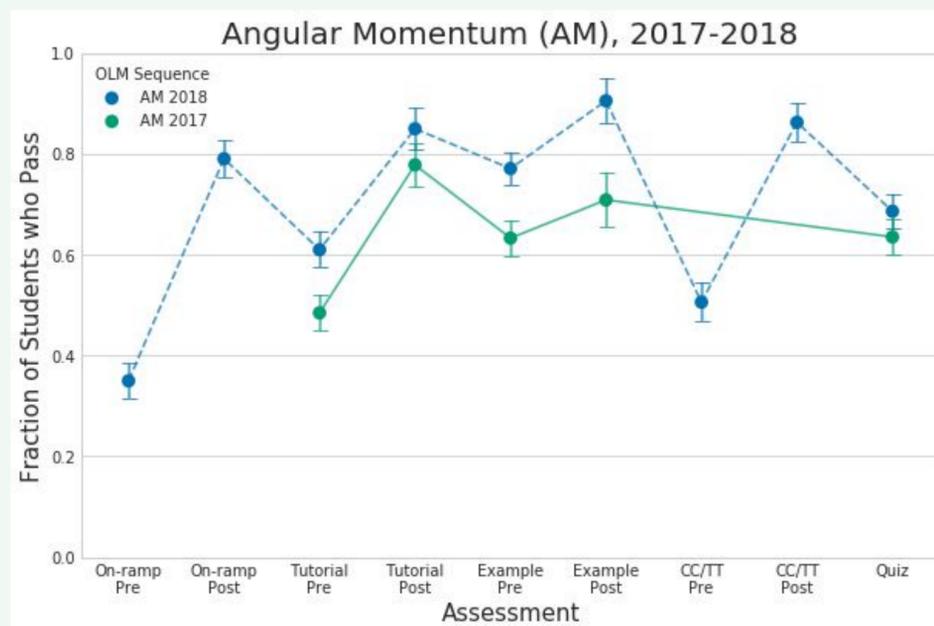
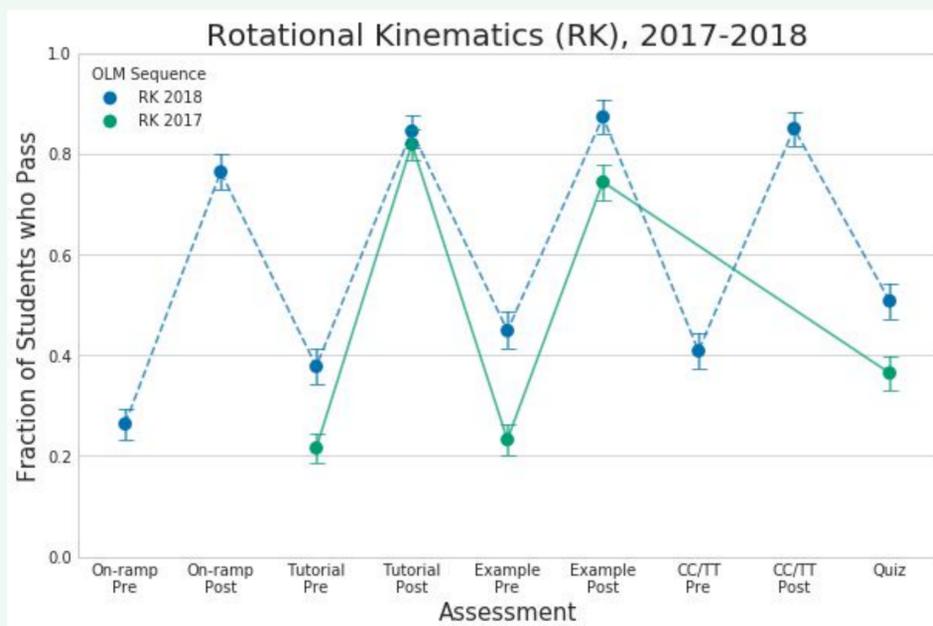
- Does answering several compare-contrast style questions lead to better performance on a subsequent transfer task compared to completing several guided-tutorial style questions?
- Does the addition of an “on-ramp” module designed to develop basic procedural skills improve students’ performance on subsequent problem solving tasks?

Study Design



Each module contains an assessment and instruction. Students are required to make at least one attempt on the AC first, then are allowed to view the IC, and then make subsequent attempts on the AC. Modules 1 and 4 were added for the 2018 implementation. Students are randomly assigned to receive two different versions of the IC in module 4, a compare contrast task and a tutorial.

Results



The passing rates on each assessment for the two OLM sequences. Passing rates are calculated as the fraction of students who attempt the assessment and pass within two attempts. Passing rates on Post assessments are calculated only for those who did not pass in Pre.

Student performance differences from 2017 to 2018. Of the 30 Fisher's exact tests performed comparing performance of students in 2017 to those in 2018, the 10 below were the only results significant at $p < 0.05$. We also report the p -values adjusted by the Holm-Bonferroni method.

Population	Assessment	2017	2018	p	p_{adj}	1st Attempt Duration	Assessment	2017	2018	p	p_{adj}
		Pass Rate	Pass Rate					Pass Rate	Pass Rate		
All	RK Tutorial Pre	22%	38%	< 0.01	0.01	> 30 s	RK Tutorial Pre	20%	40%	< 0.01	0.02
All	RK Example Pre	23%	45%	< 0.01	< 0.01	> 30 s	RK Example Pre	22%	51%	< 0.01	< 0.01
All	RK Quiz	36%	51%	< 0.01	0.12	> 30 s	RK Quiz	36%	52%	0.01	0.28
All	AM Tutorial Pre	49%	61%	0.02	0.48	≤ 30 s	AM Tutorial Pre	42%	68%	< 0.01	0.06
All	AM Example Pre	63%	77%	< 0.01	0.12	≤ 30 s	AM Example Pre	48%	75%	< 0.01	0.05

We saw an increase in passing rate from 2017 to 2018 in the Pre stages of the RK Tutorial and RK Example modules; evidence for the benefit of the on-ramp module because students have not yet accessed the IC of the two modules in the Pre stage.

We found no significant differences in subsequent Quiz module performance between students subjected to the Compare-Contrast and Tutorial conditions



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