

Student performance and behavior differ significantly between Mastery based and Traditional online homework conditions

Comparing student behavior in mastery and conventional style online physics homework

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poster explanation



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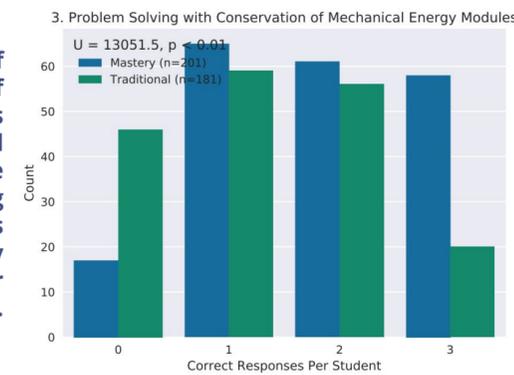
Background

- Most online homework experiences have inherited a traditional “instruction - homework - quiz” style. Mastery learning lets students advance at a rate that enables them to learn at a pace closer to the needs of each individual.
- To compare mastery and conventional conditions, we created 19 Mastery based modules in an online learning system called Obojobo for calculus-based introductory energy and momentum topics and reorganized the exact same content into 6 Traditional modules.
- Two classes of approximately 220 students each participated and conditions were switched between classes after the energy modules.
- We compared major study sessions of the instructional material and correct response counts on the assessment between the conditions. A visit or visits to the instructional component of a module is a student’s major study session.

Adjusted p -values from Mann-Whitney U comparisons of major study session time for Mastery and Traditional conditions. N_p = number of correct responses after studying.

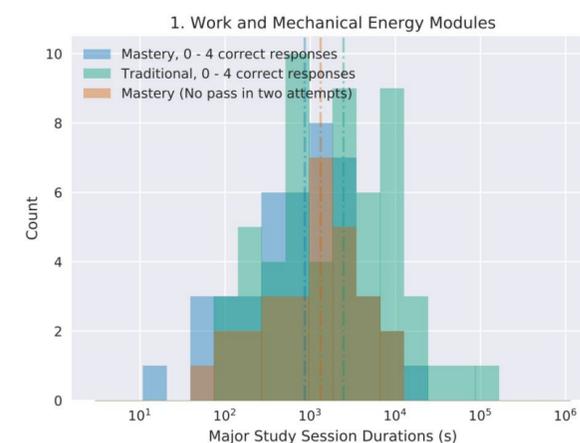
Module	N_p Group	Mastery	NoPassin2
1	0-4	0.01*	0.08
	5-6	0.01*	0.43
	7	< 0.01*	0.17
2	0-2	0.02*	0.02*
	3-4	0.01*	0.03*
	5	0.14	< 0.01*
	6	< 0.01*	< 0.01*
3	0-1	< 0.01*	< 0.01*
	2	0.04*	0.37
	3	0.02*	0.50
4	0-3	< 0.01*	< 0.01*
	4-5	< 0.01*	0.30
	6	< 0.01*	0.10
	7	< 0.01*	0.10
5	0-1	0.37	0.37
	2	0.07	0.37
	3	0.05*	—
6	0-2	0.07	0.07
	3-4	0.07	0.39
	5	0.07	0.29
	6	0.07	0.29

Distributions of the number of correct responses on Traditional module 3 and the corresponding Mastery modules immediately following a major study session.

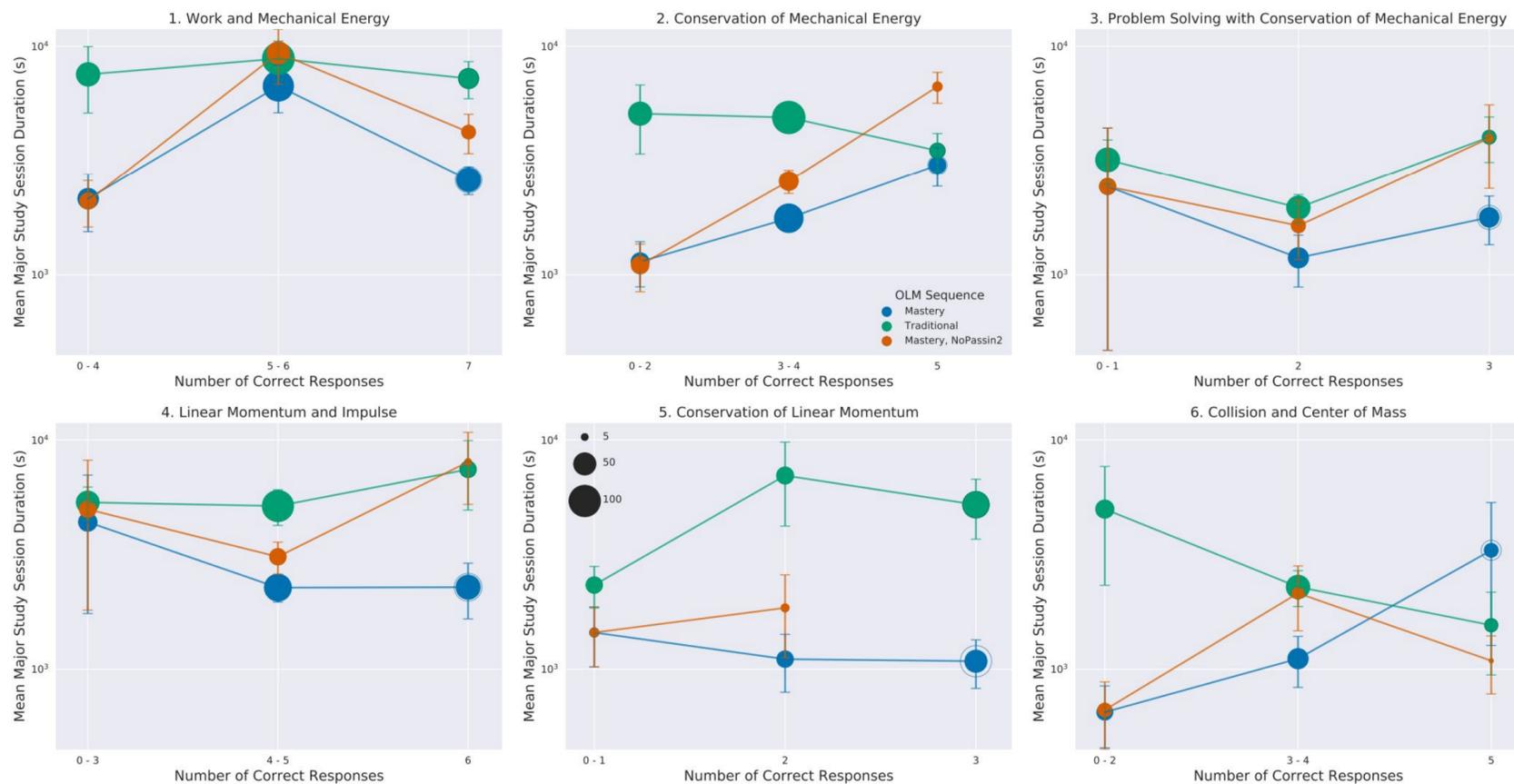


Module	U statistic	p-value
1	19340.5	0.03*
2	17835.5	0.03*
3	13051.5	< 0.01*
4	14512.0	< 0.01*
5	10997.0	0.01*
6	7377.0	0.11

Mann-Whitney U comparisons of correct response distributions for Mastery and Traditional groups in the entire sequence of modules.



Major study session durations for students who answered 0-4 assessment problems correctly on Traditional module 1 and the corresponding Mastery modules, including mastery students who did not pass before two attempts.



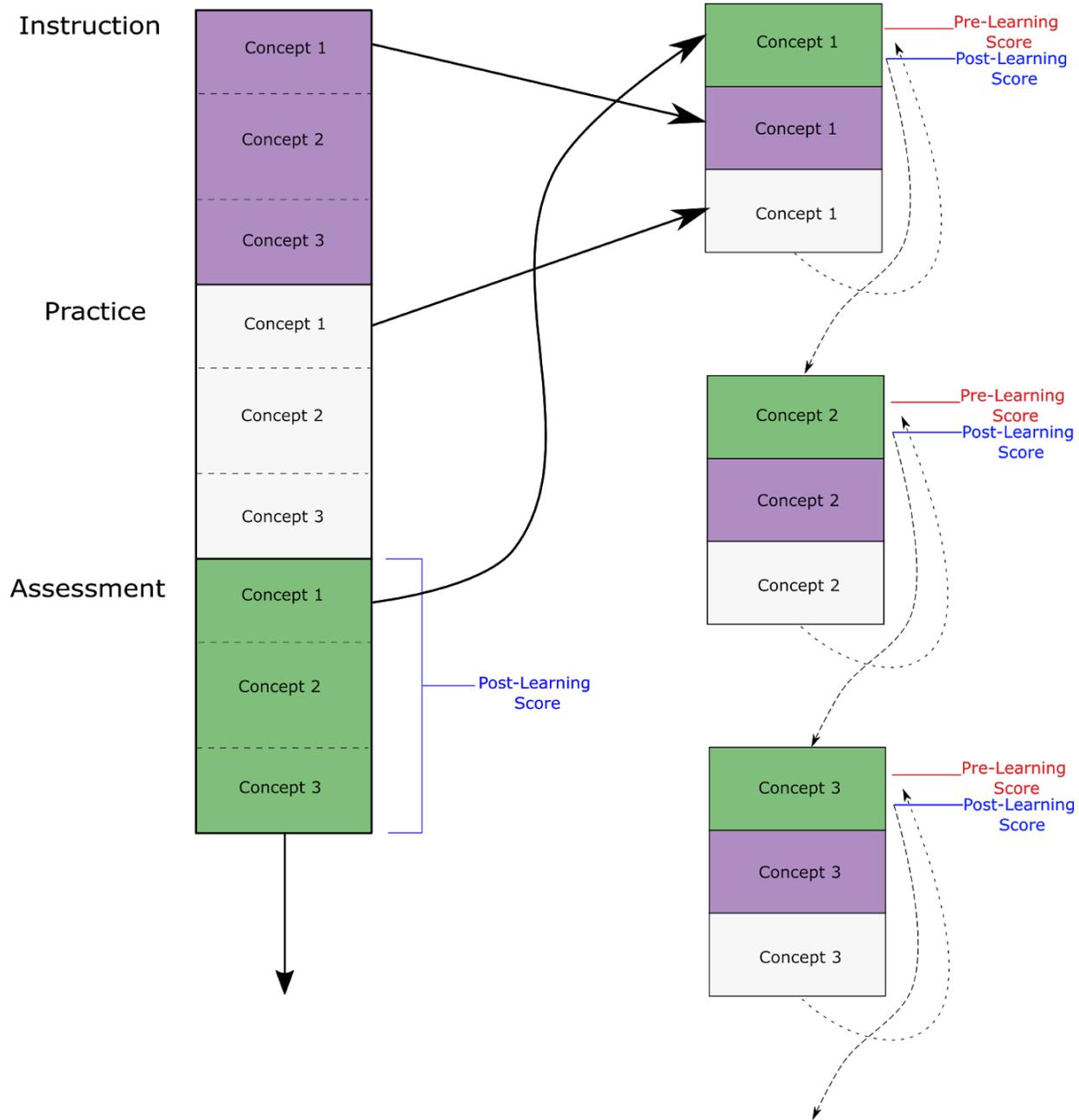
Students’ major study session durations grouped by the number of correct responses in attempts after their major study session. Error bars show standard deviations in each distribution, marker sizes show the number of students in each group, and empty circles show the size of the group if we include students who passed the assessment before having a study session.

Results

- More students in the Mastery condition answered more assessment problems correctly on every module, even when the conditions are switched between the classes.
 - We can’t say that students have better mastery of knowledge in the Mastery condition because the assessment problems were not administered in the same setting.
- Students spent significantly more time studying instructional content in the traditional modules.
 - Students in the Mastery condition can skip the instruction component of a module if they pass the assessment on their initial attempt, which saves a significant amount of time.
- When students in the Mastery condition didn’t pass a module on their initial attempt (NoPassin2), they tended to spend similar amounts of study time as those in the Traditional condition.
 - Students who took more than two attempts to pass a Mastery module have similar behavior to students in the Traditional condition.

Traditional

Modular



Setup

Calculus-based introductory mechanics

Section 1

10 Mastery modules

3 Traditional modules

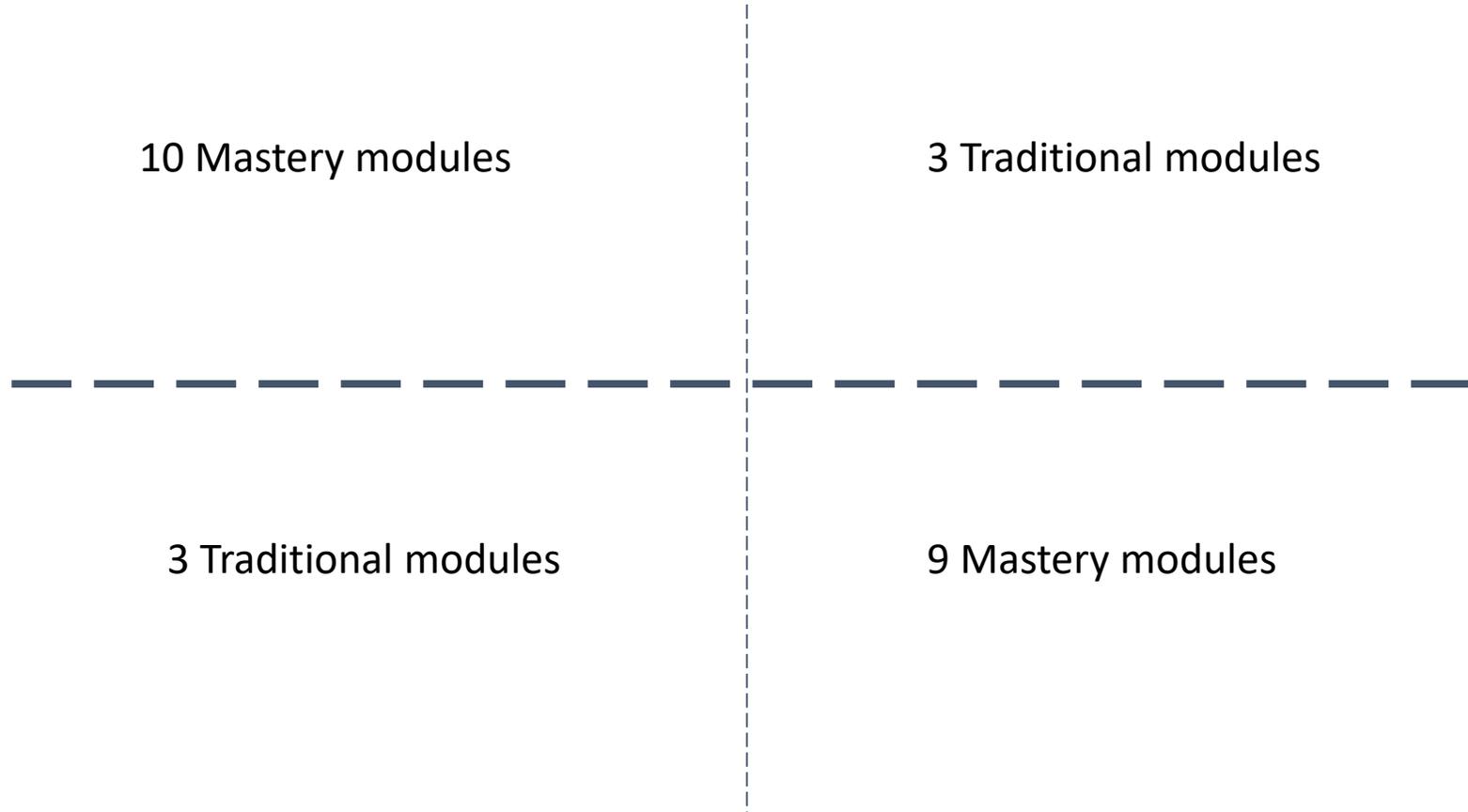
Section 2

3 Traditional modules

9 Mastery modules

Energy

Momentum



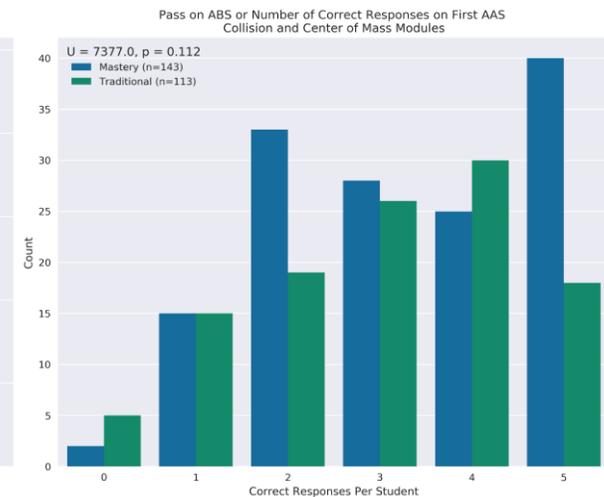
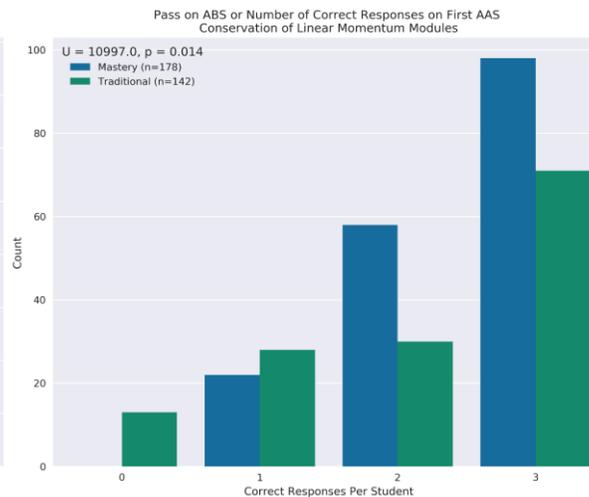
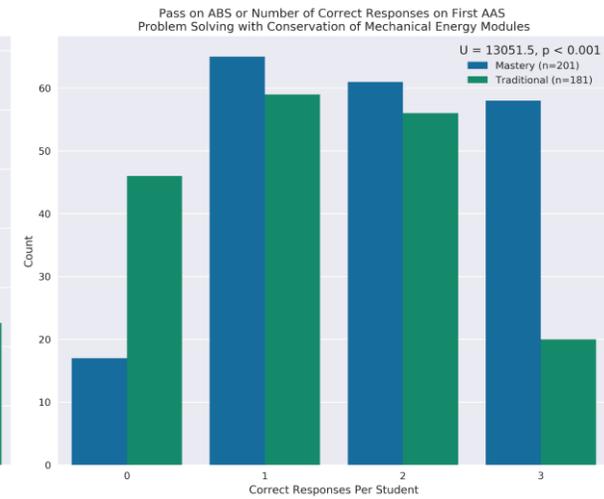
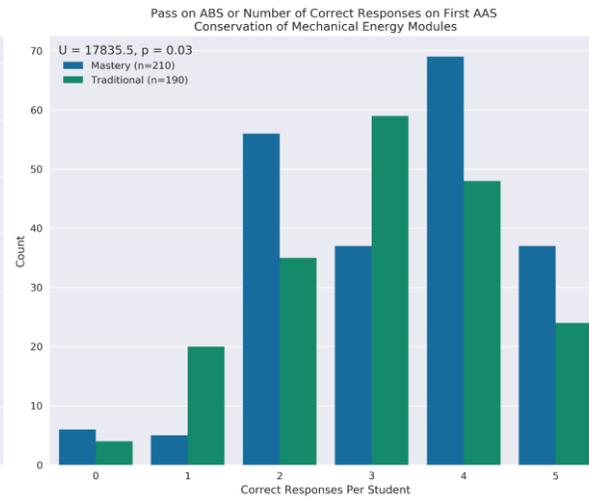
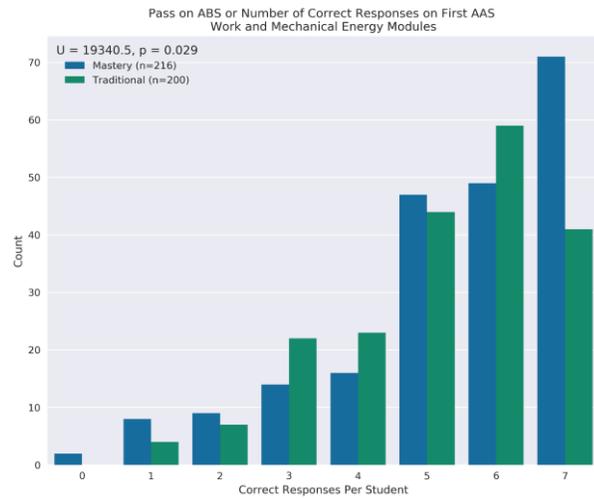
H1: Students answer more assessment problems correctly in the Mastery condition.

H2 - For similar numbers of correct responses, the time spent on learning will be:

- more uniform in the traditional condition
- more diverse in the mastery condition

H3 - Mastery condition students who didn't pass on their initial attempts spend equal time studying as those in the Traditional condition

Correct Response Distributions



Study Session Distributions

