



Test-enhanced Learning in a Therapeutics Course

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BACKGROUND

- Test-enhanced learning refers to an increase in retention of knowledge or skills by testing
 - Testing improves learning by requiring active retrieval of information and/or helping develop an effective test-taking strategy
- The Therapeutics II course is the second of four Therapeutics courses in the UCSF Doctor of Pharmacy curriculum
- In 2017, 4 graded written tests were administered instead of 2 graded written tests in the preceding years
- Having 4 vs 2 graded written tests may increase test-enhanced learning
- In addition, having 4 graded tests may improve students' time management skills
- However, more graded tests may increase levels of students'

PURPOSE

- To confirm test-enhanced learning with 4 graded written tests compared with 2 graded written tests
- To assess student perception of and preferences for having 4 vs. 2 graded written tests

METHODS

- **To confirm test-enhanced learning with 4 graded written tests**
 - We included students who took Therapeutics II in 2016 and 2017.
 - Student cohort who took the course in 2016 (i.e., 2016 cohort) served as a historical control.
 - We compared the median score change from the first to the last tests between 2017 and 2016 student cohorts
 - In 2017, the median score change was measured from Test 1 to Test 4
 - In 2016, the median score change was measured from midterm to final test
- **To assess students' perception and preferences**
 - We surveyed the 2017 student cohort after the course
 - Since Therapeutics I course administered 2 graded written tests, we surveyed students about the change in levels of perceived stress and test anxiety as well as self-confidence in time management skills by using Likert scale
 - We also surveyed on helpful and unhelpful aspects of having 4 vs. 2 graded written tests
 - In addition, we asked about their preference between having 4 and 2 graded written tests in a Therapeutics course

RESULTS

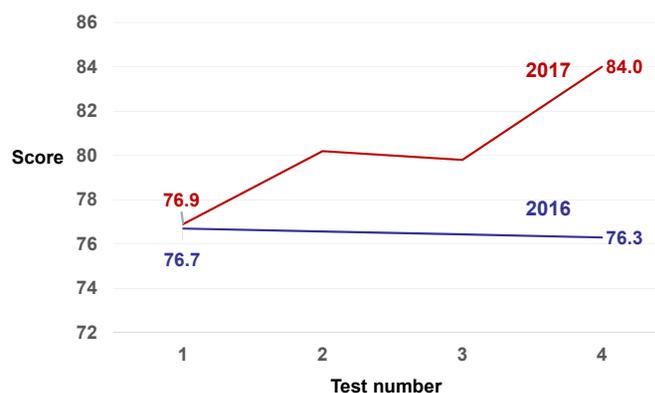
1. Comparison of test score change between the 2016 and 2017 cohorts

- 124 and 119 students enrolled in 2016 and 2017, respectively

Table. Characteristics Between 2016 and 2017 Cohorts Taking Therapeutics II.

Item	2016 (n=124)	2017 (n=119)	P-value
Male (%)	37 (29.8)	42 (35.3)	0.82
Students repeating the course (%)	4 (3.2)	2 (1.7)	0.56
Therapeutics I grade (%)			0.40
A	11 (9.1)	5 (4.3)	
B	53 (43.8)	60 (51.3)	
C	37 (30.6)	37 (31.6)	
D	18 (14.9)	12 (10.3)	
F	2 (1.7)	3 (2.6)	

Figure. Change in the median score of graded written tests



- While the median score of the final written test was not significantly different from that of the midterm test in 2016 cohort (p=0.95), the median scores of the 2017 cohort increased over time and the median score of the last test was about 7 points higher than that of the first test (84.0 vs. 76.9; p<0.0001)

- In a multivariable mixed effect model analysis, only the number of tests was significantly associated with an increase in the overall test score in the 2017 cohort (parameter estimate: 0.82; p=0.009)

2. Perception and preferences

- Survey response rate: 91.6%
- Compared with having 2 tests,
 - 81.9% of students reported having 4 tests improved level of stress substantially or slightly
 - 87.3% reported having 4 tests improved level of test anxiety substantially or slightly
 - 89% reported having 4 tests improved time management skills substantially or slightly
- 69% reported studying learning materials as planned in Therapeutics II compared with 37.3% in Therapeutics I (p=0.004)
- Only 29.1% reported cramming before a test at least once in Therapeutics II compared with 46.6% in Therapeutics I (p=0.001)
- Top 3 helpful aspects of having 4 tests were staying on track of learning materials, retaining knowledge longer, and additional opportunities to recover
- Top 3 unhelpful aspects were increased academic workload, decreased time for relaxation, and reduced time to study for the other courses
- 92.7% students preferred having more than 2 written graded tests in a Therapeutics course

LIMITATIONS

- Instead of concurrent control, a historical control was used
- Different tests were administered between the 2016 and 2017 cohorts due to test security
- Only the 2017 cohort was surveyed
- Content delivery models were different between Therapeutics I and II courses

CONCLUSIONS

- Having more than two graded written tests in a Therapeutics course may enhance student learning, improve time management skills, and reduce stress and tests anxiety

Approved by the UCSF Committee on Human Research

