



UNIVERSITY OF
ARKANSAS

Department of Mathematical Sciences

Pre/Post Analysis of the Change in Learning
Objective Competency of College Algebra Students

FY 20 (Fall 2019, Spring 2020)

Data

Data were collected on all students enrolled in College Algebra (MATH 1203 and MATH 1203L) for the fall semester of 2019 and spring semester of 2020. During these terms students were given a Pre-Assessment (pre-test) of ten items at the beginning of the semester which were also included in the final exam (post-test) at the end of the semester. These items measured one or more of the following learning objectives:

- (MATH LO 1) Demonstrate an understanding of college-level mathematical concepts and tools.
- (MATH LO 2) Be able to analyze and critique logical arguments.
- (MATH LO 3) Develop models to solve real-life problems.
- (MATH LO 4) Formulate and solve a problem in mathematical terms, using appropriate tools and methods.
- (MATH LO 5) Demonstrate fluency with the language and notation of mathematics.
- (MATH LO 6) Express quantitative and logical ideas with precision.

Courses

- MATH 1203: This course meets three days per week for students scoring at least 23 on the math section of the ACT (or 570 on the SAT math section) or scoring at least 46 on the ALEKS Math Placement Test.
- MATH 1203L: This course meets three days per week plus 1 or 2 lab hours per week depending on ACT/SAT/ALEKS Math Placement Test scores.

Student Numbers

All students were to be required to take both the pre-test and post-test, though some, due to extenuating or unusual circumstances, did not. In addition, students who withdrew from the course did not take the post-test. In total, 903 students in MATH 1203 and 929 students in MATH 1203L took both the pre-test and the post-test during these semesters.

Analyses

Paired t-tests were conducted on each item of the pre-test/post-test. These results are included in the tables below. This table contains which learning objectives are measured by the items, the t statistic, p-value, Cohen's d effect size, the percentage of students who answered the item correctly in the pre-test, and the percentage of students who answered the item correctly in the post-test. With ten statistical analyses, the overall alpha value is set at 0.05 for the course and $0.05/10 = 0.005$ for each item within the course.

Results

For both courses, students were significantly more likely to answer each of the ten items correctly in the post-test than the pre-test. All items in both courses have an effect size of at least 0.2, indicating the effect of the course on the difference in scores for all items is likely meaningful. For MATH 1203 the effect size was small for two items, medium for three items and large for five items. For MATH 1203L, the effect size was medium for three items and large for seven items.

1203 FY20 (Fall 19-Spring 20)

Question Number	Learning Objectives	t	p-value	Cohen's d	Pre-Test Percentage Correct	Post-Test Percentage Correct
1	LO1, LO4	11.8	<0.0001	0.4	38.3%	60.7%
2	LO2, LO3	10.0	<0.0001	0.3	73.3%	89.5%
3	LO1, LO4	21.0	<0.0001	0.7	19.7%	60.0%
4	LO4, LO5	20.4	<0.0001	0.7	32.4%	71.7%
5	LO2, LO3, LO5	36.8	<0.0001	1.3	10.8%	76.6%
6	LO4	20.7	<0.0001	0.8	9.5%	47.3%
7	LO1, LO3	26.7	<0.0001	1.0	8.6%	59.0%
8	LO1, LO4	16.2	<0.0001	0.6	3.7%	31.0%
9	LO2, LO5	25.2	<0.0001	0.9	31.7%	76.4%
10	LO1, LO4	25.7	<0.0001	0.9	40.3%	87.6%

Note: As suggested by Cohen: d=0.2 is a "small" effect size, d=0.5 "medium", and d=0.8 "large."

1203L FY20 (Fall 19-Spring 20)

Question Number	Learning Objectives	t	p-value	Cohen's d	Pre-Test Percentage Correct	Post-Test Percentage Correct
1	LO1, LO4	33.6	<0.0001	1.1	2.4%	59.0%
2	LO2, LO3	34.1	<0.0001	1.1	23.1%	83.4%
3	LO1, LO4	21.2	<0.0001	0.7	36.2%	75.6%
4	LO4, LO5	24.6	<0.0001	0.8	5.5%	48.4%
5	LO2, LO3, LO5	29.7	<0.0001	1.0	0.1%	48.7%
6	LO4	15.5	<0.0001	0.5	55.0%	83.5%
7	LO1, LO3	37.8	<0.0001	1.2	21.8%	85.1%
8	LO1, LO4	40.4	<0.0001	1.3	14.8%	82.4%
9	LO2, LO5	17.6	<0.0001	0.6	0.2%	25.3%
10	LO1, LO4	24.4	<0.0001	0.8	2.4%	43.2%

Note: As suggested by Cohen: d=0.2 is a "small" effect size, d=0.5 "medium", and d=0.8 "large."