Use of ALEKS and Grades in MATH 005, Fall 2015

Executive Summary

- Students spent an average of 88 hours on ALEKS over the quarter. Distribution of hours is uneven across weeks.
- Students who spent more time on ALEKS earned higher grades in Math 005. This relationship holds even when accounting for how students distribute their total study time across weeks and several student characteristics.

Context

ALEKS is an adaptive learning technology that the UCR Math Department is piloting in MATH 005 (pre-calculus) classes. This memo investigates the relationship between time spent using the ALEKS system and final course grade in MATH 005, as taught by one instructor in the fall of 2015.

Usage of ALEKS

Students spent an average of 88 hours on ALEKS over the quarter. While there is a relatively large amount of variation (with a standard deviation of 36 hours around the mean), even the students who used ALEKS the least spent almost 10 hours and those who used it the most spent well over 100 hours. The average time spent each week ranged from five to ten hours but was marked by distinct peaks in weeks two, five and eight.

T*able 1. Total hours spent with ALEKS over ten weeks*	
Minimum	9.25
25% Quartile	63.54
Median	84.23
Mean	88.34
75% Quartile	110.17
Maximum	205.12
Standard Deviation	36.10

Figure 1: Hours spent on ALEKS each week
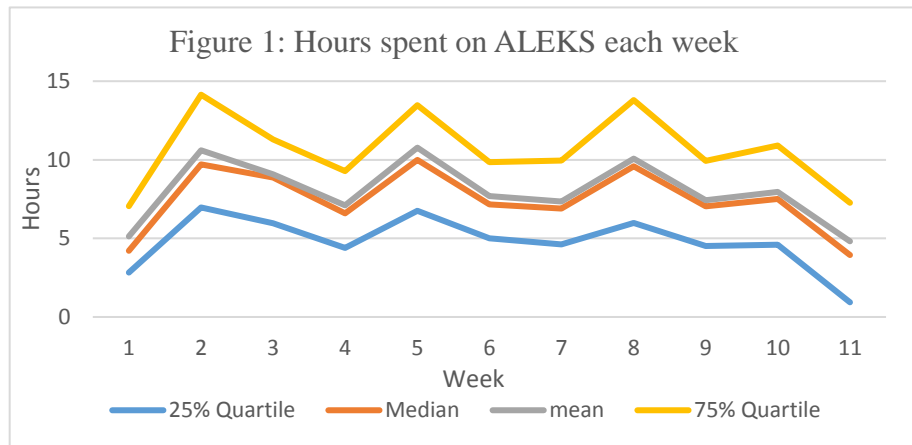
Grades and Usage of ALEKS

Figure 2 shows average total number of hours spent on ALEKS and course grade. Students who earned As spent a bit over 100 hours, while most other students who earned passing grades spent between 80 and 90 hours. Students who earned Cs spent almost as much total time over the quarter as those who earned As, but usage falls off quickly for students earning C- and below.

Figure 2: Average hours ALEKS by MATH 005 grade
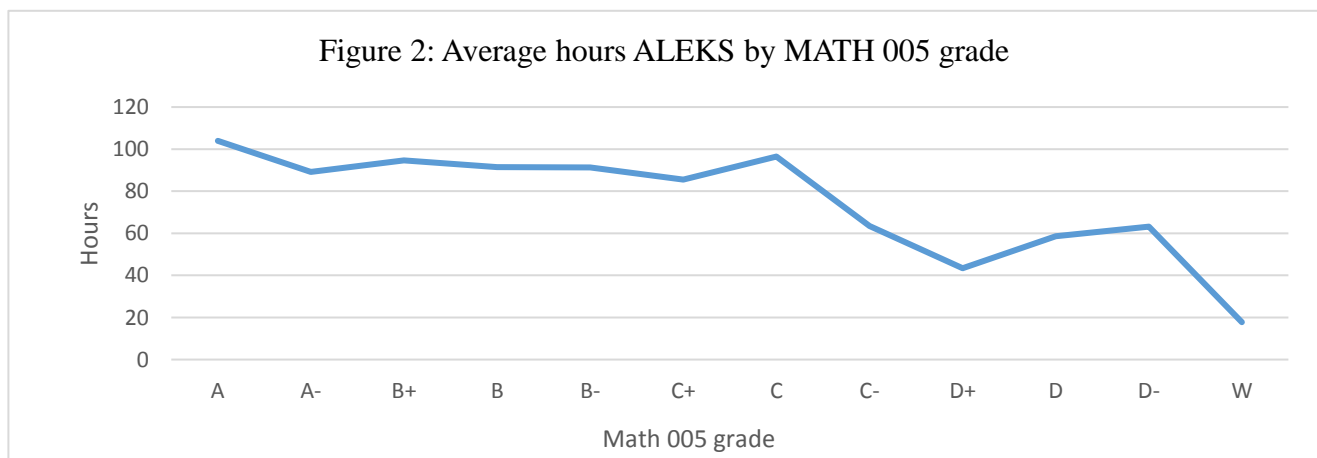
Another, more sophisticated, way to get at this relationship is using regression techniques. Regression techniques address the relationship between one independent variable (here time spent on ALEKS) and a dependent variable (here grade in MATH 005). Regression techniques can also include control variables, such as student characteristics, to separate out the effect of these variables have on the dependent variable while simultaneously estimating the relationship between the main independent and dependent variable.

Table 2 presents results from a number regressions. The first includes just the ALEKS placement score and final grade, and results indicate students who had higher placement scores went on to earn higher grades in MATH 005. The second regression model adds time spent on ALEKS and this relationship is positive, even controlling for original placements. The results suggest each additional hour spent on ALEKS raises final grades in MATH 005 by about 0.01 grade points. Although this is not a particularly large effect, recall the median usage time was 84 hours. If student moved from the 25th percentile to the median by spending approximately 25 more hours on ALEKS over ten weeks they might expect their grade to increase by 0.25 grade points. A relationship of about this size is observed in other regressions.

Table 2: Regression models with final grade in MATH 005 as dependent variable and various independent and control variables (standard errors in parentheses)

	Model 1	Model 2	Model 3	Model 4
ALEKs placement score	1.503 (0.490)**	2.087 (0.464)**	1.973 (0.468)**	1.942 (0.470)**
Hours Spent on ALEKS		0.010 (0.002)**	0.012 (0.002)**	0.011 (0.002)**
Standard deviation of hours by week			-0.092 (0.059)	
Above average fall GPA				
Black				-0.073 (0.225)
Asian				0.069 (0.140)
Caucasian				0.173 (0.189)
Native/other				0.655 (0.468)
Freshmen				0.269 (0.186)
Male				0.160 (0.126)
CHASS				-0.285 (0.129)*
Constant	2.527 (0.162)**	1.480 (0.238)**	1.653 (0.262)**	1.166 (0.316)**
R^2	0.05	0.19	0.21	0.25
N	182	182	182	179

Note: *$p<0.05$, **$p<0.01$

Regression model 3 adds a variable for standard deviation of time spent on ALEKS each week. Students who cram (by spending a large share of their total hours concentrated in some weeks, for example just before a midterm) would have high standard deviations while students who engaged in more steady studying activity (using ALEKs an equal number of hours each week) would have lower standard deviations. These results do not support the idea that these kinds of variations in behavior are related to final grades, although Figure 1 clearly shows students are concentrating their usage in some weeks more than others.

Regression model 4 includes a handful of demographic variables and finds that a students' racial/ethnic group or gender are not significantly related to their grade. Students from majors in CHASS do tend to score significantly lower in MATH 0005.

Limitations and Further Study

One limitation is this study involves only one instructor, one course and not a particularly large number of students. Analyzing similar data when more courses have been taught with ALEKS may offer a better picture of how using ALEKS impacts grades. It may also be instructive to identify two offerings of MATH 005 taught by the same instructor using ALEKS in one offering but not the other and compare student outcomes. Another way to get at the effectiveness of ALEKS would be to examine the impact of students in MATH 005 courses that used ALEKS as they move into more advanced coursework.