ALEKS Usage Patterns and Grades in MATH 005, Winter 2016

Gary Coyne, Director of Evaluation and Assessment

Yuting Lin, Graduate Student Researcher

Executive Summary

- Students spent an average of 60 hours using ALEKS in MATH 005 in winter 2016.
- Most students found ALEKS easy to use. Many also indicated it increased engagement with the course; however about as many also indicated that ALEKS did not seem to dramatically change their engagement with the course.
- In fall 2015 the section of MATH 005 that used ALEKS had a higher course average than the section that did not. However, students who used ALEKS in MATH 005 in fall 2015 appeared to have performed worse in MATH 009A in winter 2016, than students who had not previously used ALEKS.
- Regression techniques indicated a positive relationship between time spent using ALEKS and final grade in MATH 005 in winter 2016.
- These analyses involved relatively small numbers of students and instructors. Another limitation is that students who spent more time using ALEKS may be more motivated and thus earned higher grades independent of ALEKS. One way to overcome these limitations might be to collect more data in a way that more closely approximates an experimental design.

Introduction

Following up on an earlier examination of ALEKS, this memo provides detail on student usage patterns, perceptions of, and relationships between usage and outcomes in MATH 005 and follow on courses in winter 2016. This memo also makes comparisons between outcomes for groups of students in similar courses, where some students had access to ALEKS and some did not.

Use of ALEKS

Students in MATH 005 in winter 2016 used ALEKS, on average, about 60 hours over the ten weeks of the quarter. The students who logged the fewest hours on ALEKS put in about two to three hours per week while those at the higher end were averaging seven or more hours per week. Usage by week (in Figure 1) shows distinct peaks in weeks five and ten as students cram for mid-terms and finals. Total usage in winter 2016 was lower than in fall 2015 (where average hours were close to 90).

Table 1: Total hours spent with ALEKS, Winter 2016

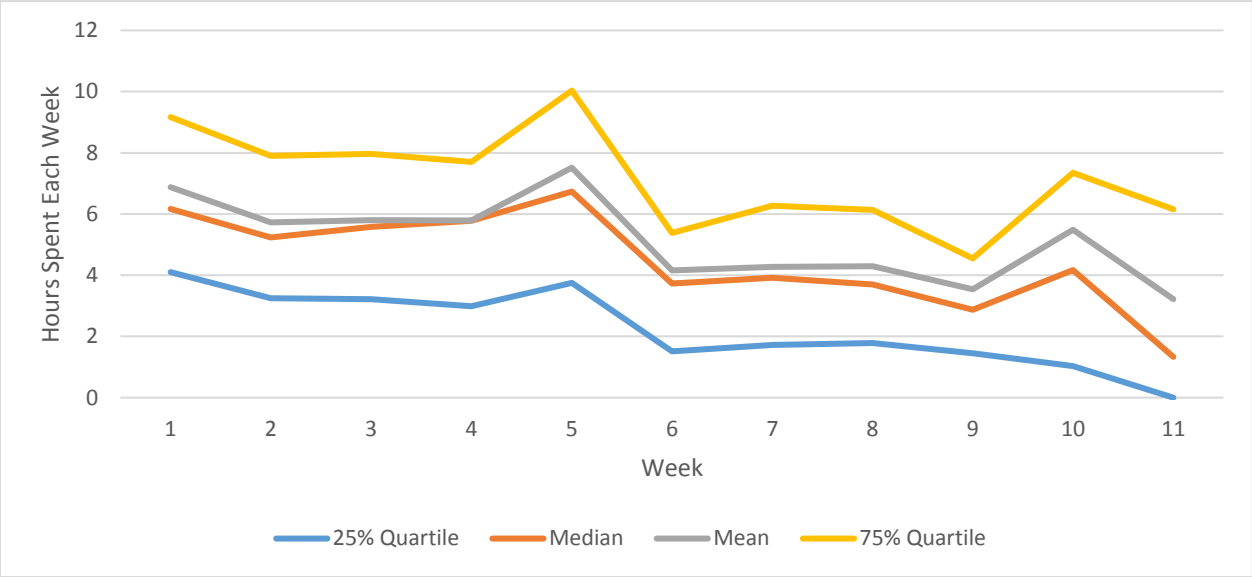
Statistics	
25% Quartile	30.48
Median	54.57
Mean	56.69
75% Quartile	73.82
Standard Deviation	33.93

Student Perceptions of ALEKS

At the end of winter quarter, students were invited to take a short survey about their perceptions of ALEKS. The response rate was 47%. Complete results are shown in the Appendix.

The majority of students indicated that ALEKS was easy to use. Most students indicated using ALEKS often in discussion sections, where there were weekly ALEKS quizzes, and infrequently in lecture, where instructors had other expectations of students' time. About 40% of students gave positive responses to questions about how ALEKS improved this course relative to other math courses and, in another item, about how ALEKS fostered engagement. Slightly smaller numbers of students gave answers that were neutral or negative on these two items. A clear majority of students indicated that ALEKS and other sources (i.e.: texts and lectures) both contributed in roughly equal ways to their overall learning. Taken together, this suggests while some students saw ALEKS positively, many reported that ALEKS did not fundamentally change their experience relative to other math courses.

Figure 1: Hours Spent on ALEKS by Week of Quarter, Winter 2016



ALEKS Impact on Average Course Grades

One way to assess the impact of ALEKS on learning is to compare the final grades of students who had access to ALEKS with those who did not. Table 2 presents average grades for students who used ALEKS when they took MATH 005 in fall 2015 (top row) and those who did not (bottom row) across several pairs of courses. (Note, these comparisons do not include the winter 2016 MATH 005 students whose usage patterns are discussed above. Typically, a high proportion of students who take MATH 005 in the winter are "off sequence," because they required developmental or preparatory course work in the fall or failed the course and are retaking it.)

	MATH 005 Different Instructors in Fall 2015	MATH009A in Winter 2016, following MATH 005 in Fall 2015	MATH009A in Winter 2016, following MATH 005 in Fall 2015 - No F grades
ALEKS Users	2.98** (184)	2.50** (134)	2.72 (122)
Non-ALEKS Users	2.26** (176)	2.86** (112)	2.88 (108)

The first column compares students who took MATH 005 from different instructors at the same time (fall 2015) and shows students in the course with ALEKS had final grades that were more than 0.50 grade points higher. The second column follows students in a MATH 005 section with ALEKS in the fall of 2015 into MATH 009A in the winter of 2016 and compares them to other students in MATH 009A who did not have access to ALEKS when they took MATH 005 in the fall. The ALEKS group's final grades were about 0.30 points lower than those who did not use ALEKS. There seemed to be an usually large proportion of students earning Fs in MATH 009A in the winter of 2016 (5% of the total). When these students are removed, as in the final column, ALEKS users still score about 0.20 grade points lower but the difference is no longer statistically significant.

Table 3: Regression models with final grade in MATH 005 in Winter 2016 as dependent variable and various independent and control variables (standard errors in parentheses)

	Model 1	Model 2	Model 3	Model 4	Model 5
ALEKS placement score	0.011 (0.008)	0.021* (0.008)	0.020* (0.009)	0.013 (0.014)	0.022* (0.009)
Hours Spent on ALEKS		0.010* (0.004)	0.016* (0.007)	0.004 (0.006)	0.012* (0.005)
Standard deviation of hours by week			-0.163 (0.158)		
Effort				-0.091 (0.220)	
Engagement				0.071 (0.182)	
Black					-0.657 (0.548)
Asian					0.402 (0.278)
Caucasian					0.899* (0.401)
Freshmen					0.159 (0.319)
Male					-0.104 (0.275)
CHASS					0.228 (0.304)
Constant	1.224** (0.348)	0.212 (0.531)	0.363 (0.551)	1.086 (0.958)	-0.421 (0.748)
R^2	0.03	0.10	0.11	0.03	0.21
N	81	81	81	41	80

* $p<0.05$; ** $p<0.01$

Another way to investigate this relationship between ALEKS usage and course grade is using ordered logistic regression. These results are provided in Table 3 above. For students taking MATH 005 in winter 2016, Model 2 shows ALEKS placement score and hours spent using ALEKS are both positively related to grades. This indicates that ALEKS initial assessment of students' preparedness is correlated with

final grade and that time spent using ALEKS is correlated with higher grades. Model 3 shows the standard deviation of hours across weeks- a measure of how much time was crammed into certain weeks- shows no relationship to grade. This would not seem to support the idea that distributing total study time more evenly across the quarter impacts grades (independently of total time spent studying). Model 4 includes variables based on responses from the survey asking students how much effort they spent in the course relative to others and how engaged they were in the course; these variables do not indicate that students who claimed to put in more effort or were more engaged earned higher grades. While these variables do not show a significant relationship to final grades- and neither do the variables for placement score and time spent on ALEKS- note this model includes only the subset of students who completed the survey which reduces the sample size. The insignificance of these findings may be related to the small sample size or to a correlation between effort, engagement, and time spent on ALEKS. Model 5 includes basic demographic and academic characteristics. Those students who identified as white were more likely to receive higher grades but no other variable is found to have a significant correlation with final grades.

Interestingly, parallel investigations (not shown in this memo) using time spent using ALEKS in MATH 005 in fall 2015 to predict grades in MATH 009A in winter 2016 find that time spent using ALEKS during the previous quarter is positively related to later grades. This could be explained by the fact that students who spent more time on ALEKS laid down a solid foundation of knowledge that served them well in their follow on course. It may also be the case that some other factor- like study skills or motivation- lead students to spend more time with ALEKS and earn higher grades at both points in time.

Limitations

There are two significant limitations worth pointing out. First, there are limitations in the amount of data that can be brought to bear. The comparisons here only involve two courses taught by two instructors and only 271 distinct students have had a chance to work with ALEKS. Second, it is difficult to sort out causality in the relationship between ALEKS usage and grades. Better students may spend more time using ALEKS and, more or less independently, earn higher grades. One way to address these limitations would be to gather more data on ALEKS in a way that more closely approximates an experimental design, for example with the same instructor teaching one section with ALEKS and one without in the same quarter, or by attempting to observe students' level of motivation more directly, for example with an instrument like the LASSI.

Appendix – Complete Survey Results

This survey was administered online to MAHT 005 students near the end of Winter 2016. The 41 respondents represent 47% of all enrolled students.

How interested were you in taking Math 005?	N	Percent	Average MATH 005 Grade
Very interested	7	17%	2.10
Interested	20	49%	1.77
Uninterested	8	20%	1.80
Very uninterested	6	15%	1.85
Compared to your other courses this quarter, how much effort did you put into this course?	**N**	**Percent**	**Average MATH 005 Grade**
A lot more than my other courses	10	24%	1.62
More than my other courses	16	39%	2.07
About the same as my other courses	14	34%	1.69
Less than my other courses	1	2%	2.70
A lot less than my other courses	0	-	-
Think about your interaction with the ALEKS software. What would you say about ALEKS?	**N**	**Percent**	**Average MATH 005 Grade**
ALEKS was very easy to figure out and use	11	27%	1.74
ALEKS was easy to figure out and use	25	61%	1.99
ALEKS was hard to figure out and use	5	12%	1.36
ALEKS was very hard to figure out and use	0	-	-
How often did you use ALEKS during discussion sections?	**N**	**Percent**	**Average MATH 005 Grade**
I used ALEKS during many or most discussion sections	28	68%	1.73
I used ALEKS during some discussion sections	12	29%	2.22
I hardly ever used ALEKS during discussion sections	1	2%	0.70
I never used ALEKS during discussion sections	0	-	-
How often did you use ALEKS during lecture?	**N**	**Percent**	**Average MATH 005 Grade**
I used ALEKS during many or most lectures	1	2%	.
I used ALEKS during some lectures	5	12%	1.28
I hardly ever used ALEKS during lectures	8	20%	1.78
I never used ALEKS during lectures	27	66%	2.04

Now think about other math courses you have taken, either at UCR or in high school. How do you think the use of ALEKS changed this course compared to those other math courses?	N	Percent	Average MATH 005 Grade
It make this course better than other math courses I have taken	20	49%	1.92
It really did not make that much difference compared to other math courses I have taken	14	34%	1.96
It make this course worse than other math courses I have taken	7	17%	1.40
[D]o you think ALEKS helped you to engage with this course compared to other courses you have taken at UCR?	N	Percent	Average MATH 005 Grade
I was a lot more engaged in this course	6	15%	2.00
I was more engaged in this course	12	29%	1.65
I was about as engaged here as in other courses	16	39%	2.04
I was less engaged in this course	6	15%	1.85
I was a lot less engaged in this course	1	2%	.
Think about how much knowledge you have gained about the course material. How would you best describe where this knowledge came from?	N	Percent	Average MATH 005 Grade
Most of my knowledge came from ALEKS, with little coming from the instructor, textbook or other sources	6	15%	1.35
Some of my knowledge came from ALEKS and some came from the instructor, textbook or other sources	29	71%	2.04
Little of my knowledge came from ALEKS, with most of coming from the instructor, textbook or other sources	6	15%	1.40
Think about your ability to do mathematical computations (the ability to do add, subtract, multiply and divide accurately and quickly). How much would you say your computational ability improved from the time you started this course until now?	N	Percent	Average MATH 005 Grade
My computational ability is a lot better than ten weeks ago	9	22%	1.82
My computational ability is a little better than ten weeks ago	20	49%	1.53
My computational ability has not really changed from ten weeks ago	12	29%	2.38
My computational ability is actually not as good as it was ten weeks ago	0	-	-
Total	41	100%	1.84