Mc Graw Hill ALEKS®

In this study, student outcomes on the AzMERIT End-of-Course assessments are compared for schools using *ALEKS* and those that do not.

KEY FINDINGS

- Students in Algebra I at schools who used ***ALEKS***® did significantly better than those who did not with a 5.1% reduction in Level 1 (Minimally Proficient) scores and a 4.2% gain in Level 4 (Highly Proficient) scores.
- Additional reductions in the percentage of students scoring in Level 1 (Minimally Proficient) were found for ***ALEKS*** users who were also in specific subgroups:
    - Free and Reduced Lunch: 4.9% fewer in Level 1
    - Hispanic: 4.4% fewer in Level 1
    - English Language Learners: 7.2% fewer in Level 1
    - Students with a disability: 12.3% fewer in Level 1

Future research should examine impacts for additional grade levels and should also include analyzing the correlation between student-level usage and assessment outcomes.

The methodology and positive findings help this report to qualify as Tier III Promising Evidence under the criteria established by the Every Student Succeeds Act. Results for Geometry and Algebra II warrant further study given the smaller sample size.

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ALEKS Impact on AZ Schools

February 26, 2021

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This study of ALEKS implementation in AZ schools during the 2018-2019 school year finds evidence of a positive effect of ALEKS on AzMERIT End of Course Algebra I and Algebra II assessments. This report identifies the school-level effects of active ALEKS usage on achievement compared to similar AZ schools not using ALEKS.

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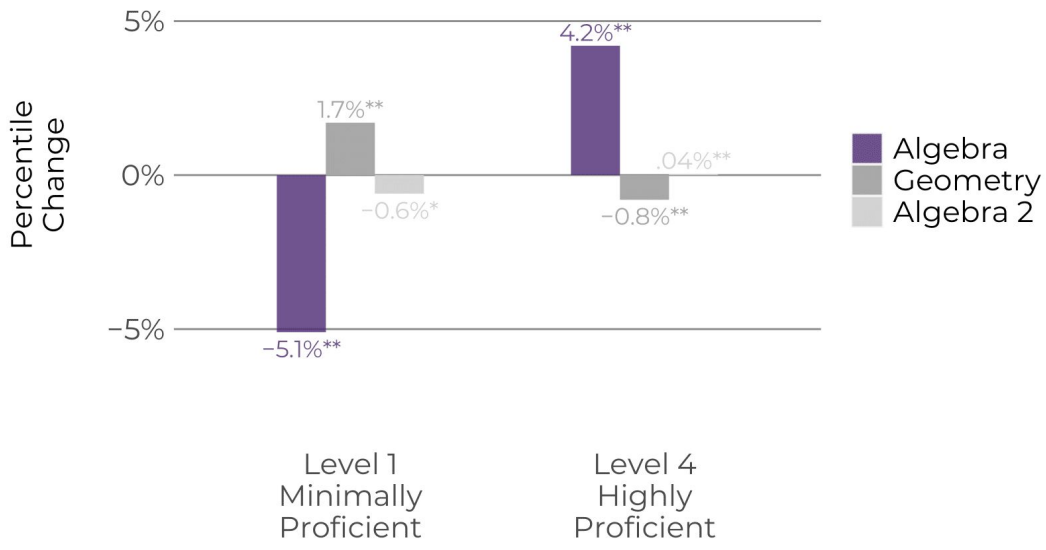
IMPACT OF ALEKS

Active use of ALEKS results in improved student outcomes on AzMERIT End-of-Course (EOC) assessments in Algebra I and Algebra II compared to a matched sample of non-users. The effect of ALEKS on schools is, on average, equivalent to a 5.1 percentile point *reduction* in the percentage of students scoring at the lowest proficiency level (Level 1 - Minimally Proficient) and a 4.2 percentile point *increase* in the proportion of students performing at the highest proficiency level (Level 4 - Highly Proficient) on the Algebra I EOC assessment. We have high confidence in this result ($p < .05$). The result was positive but smaller for Algebra II and smaller but negative for Geometry. Figure 1 shows these results for Algebra I, Geometry, and Algebra II.



> “Schools that were active users of ALEKS performed better on the EOC Algebra I and Algebra II assessments than schools that were not ALEKS users.”

FIGURE 1. EFFECT OF ALEKS ON AlGEBRA I, GEOMETRY, AND ALGEBRA II EOC ASSESSMENTS

Note. Asterisks indicate significant differences between comparison and product (* $p < .2$, ** $p < .05$). Reported effect estimates are adjusted for group differences at baseline.

These results should be taken with caution since they come from a quasi-experimental study with non-equivalent groups and use data at the course level.

DIFFERENTIAL IMPACT

We also tested the impact of ALEKS on schools that differed in the percentage of the following subgroups of students: male/female, primary racial/ethnic groups, economically disadvantaged, English language learners (ELL), and students with disabilities. We found an additional *reduction* in the percentage of students scoring at the lowest proficiency level on the Algebra I EOC assessment for students classified as eligible to receive free/reduced-price lunch (FRPL), Hispanic students, English learners, and students with disabilities. The effects ranged from 4.4% to 12.3%, compared to the average effect for all students (Figure 2).

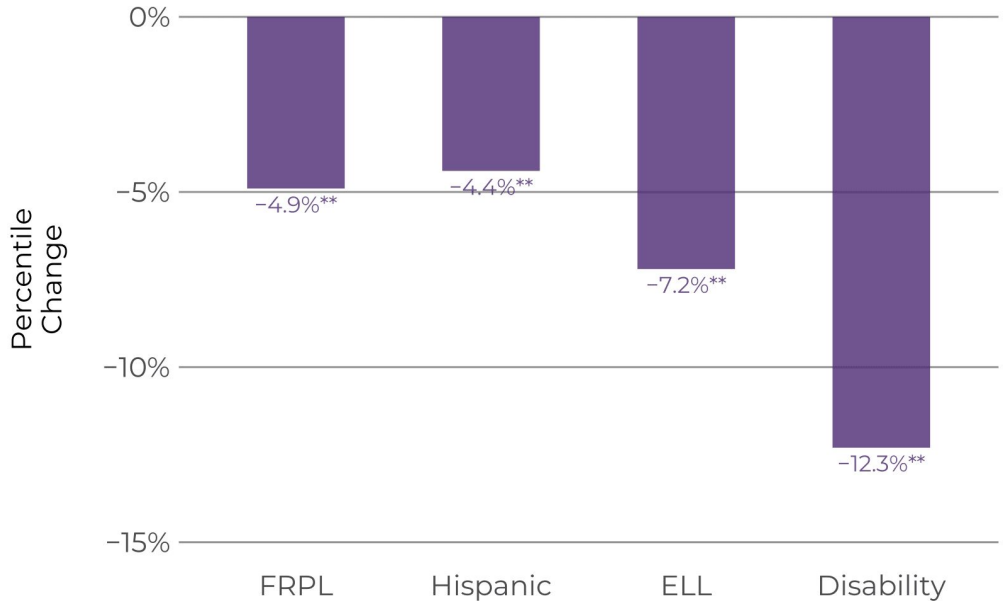


FIGURE 2. EFFECT OF ALEKS ON STUDENT SUBGROUPS SCORING AT THE MINIMALLY PROFICIENT LEVEL OF THE ALGEBRA I EOC ASSESSMENT

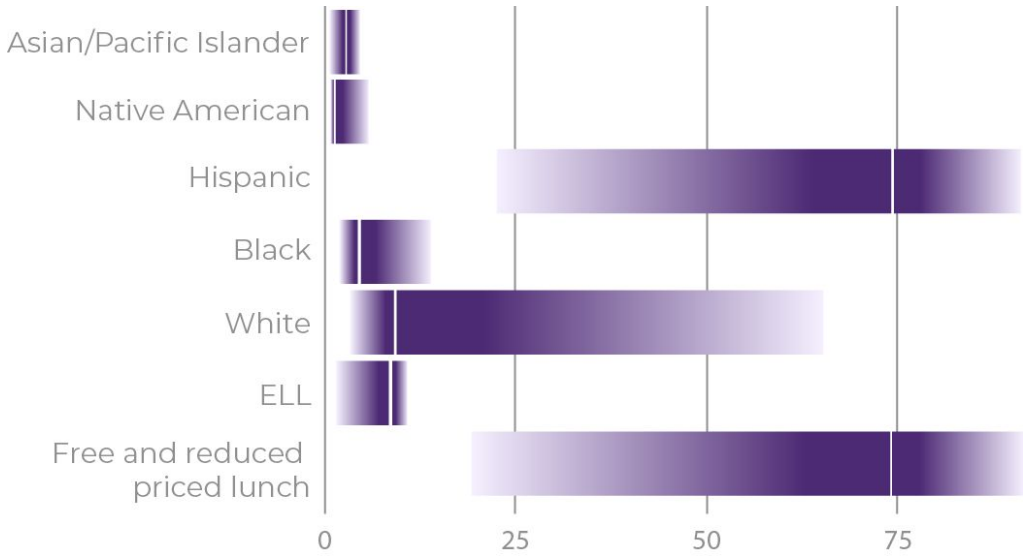
Note. Asterisks indicate significant differences between comparison and product (* $p < .2$, ** $p < .05$). Reported effect estimates are adjusted for group differences at baseline.

> “ALEKS had a positive impact on schools with higher proportions of historically disadvantaged student populations.”

COMPOSITION OF THE SAMPLE

During the 2018–2019 school year, more than 100 schools in AZ used ALEKS. For the main analysis of this study, we limited the pool of ALEKS schools to those where at least 50% of students who were tested in a particular course took at least one ALEKS assessment during the year. This limited the sample of ALEKS schools to 31 schools. Alternate approaches to selecting the treatment group, which increase the sample size but may include less active users of the ALEKS program, are shown in the Technical Details.

Figure 3 shows the distribution of demographic variables in ALEKS schools in AZ. Each bar represents the range of a variable (10th through 90th percentile) with a white line representing the median.



> “Schools that used ALEKS were more likely to have higher proportions of historically disadvantaged student populations”

FIGURE 3. CHARACTERISTICS OF ALEKS SCHOOLS IN AZ

CONCLUSION

In this comparison study, schools that were active users of ALEKS performed better on Algebra I and Algebra II EOC math assessments than schools that were not ALEKS users. These results were even stronger across disadvantaged student subgroups in the impact on the percentage of students performing at the lowest proficiency level.

The positive average impact on the Algebra I EOC assessment for schools with active ALEKS users compared to non-users, in conjunction with the positive findings for historically disadvantaged student populations, allows for a conclusion that the study provides evidence of promise. This leads to the recommendation of additional studies in other states and in districts using student-level data. It is important to note that analysis at the aggregate school level does not allow inferences about impact on individual students. It shows that courses/grades in schools that adopted ALEKS and used it actively had better outcomes, but it does not imply that requiring an individual student to take more ALEKS assessments or retain more topics will lead to a higher test score. In order to better understand ALEKS's impact on students, an assessment of student-level achievement and usage data is required.

TECHNICAL DETAILS

Data & Methodology

This report examines the effect of ALEKS usage on math performance in AZ middle and high schools during the 2018–19 school year, as measured by the EOC math assessments in Algebra I, Geometry, and Algebra II. The data available for this study were the proportion of students in each proficiency level for each EOC assessment by school. AZ reports the following four proficiency levels: Minimally Proficient, Partially Proficient, Proficient, or Highly Proficient; the percent passing is the sum of the highest two levels, Proficient and Highly Proficient (Levels 3 and 4). However, data for records representing fewer than ten students are redacted for privacy purposes, which creates a substantial amount of missing data. For the purposes of evaluation, we aggregated ALEKS usage at the course/grade-level in participating schools to match the available achievement data.

We assessed the impact of ALEKS using a matched comparison group design whereby each ALEKS course per school was matched to up to four courses of the same type in non-user schools with similar demographic characteristics and prior year test performance.

Table 1 shows the baseline equivalence of the ALEKS and comparison schools used in the main analysis, while Figure 4 illustrates the locations of the schools, ALEKS in purple and comparison in grey.

TABLE 1. BASELINE EQUIVALENCE OF THE ALEKS AND COMPARISON SAMPLES USED IN THE MAIN ANALYSIS

Characteristic	ALEKS	Comparison	Pooled standard deviation	Difference as proportion of standard deviation
Average school size	1201	982	701	.31
Percent charter schools	23	34	47	.23
Percent economically disadvantaged	61	52	28	.31
Percent White	26	39	26	.48
Percent Hispanic	60	49	27	.41
Percent Native American	3	3	18	.01

Note. Differences in the treatment and outcome groups were greater than .25 standard deviations. Based on What Works Clearinghouse (WWC) evidence standards, baseline equivalence was not achieved, as ALEKS schools tended to serve schools with a higher proportion of historically disadvantaged students.

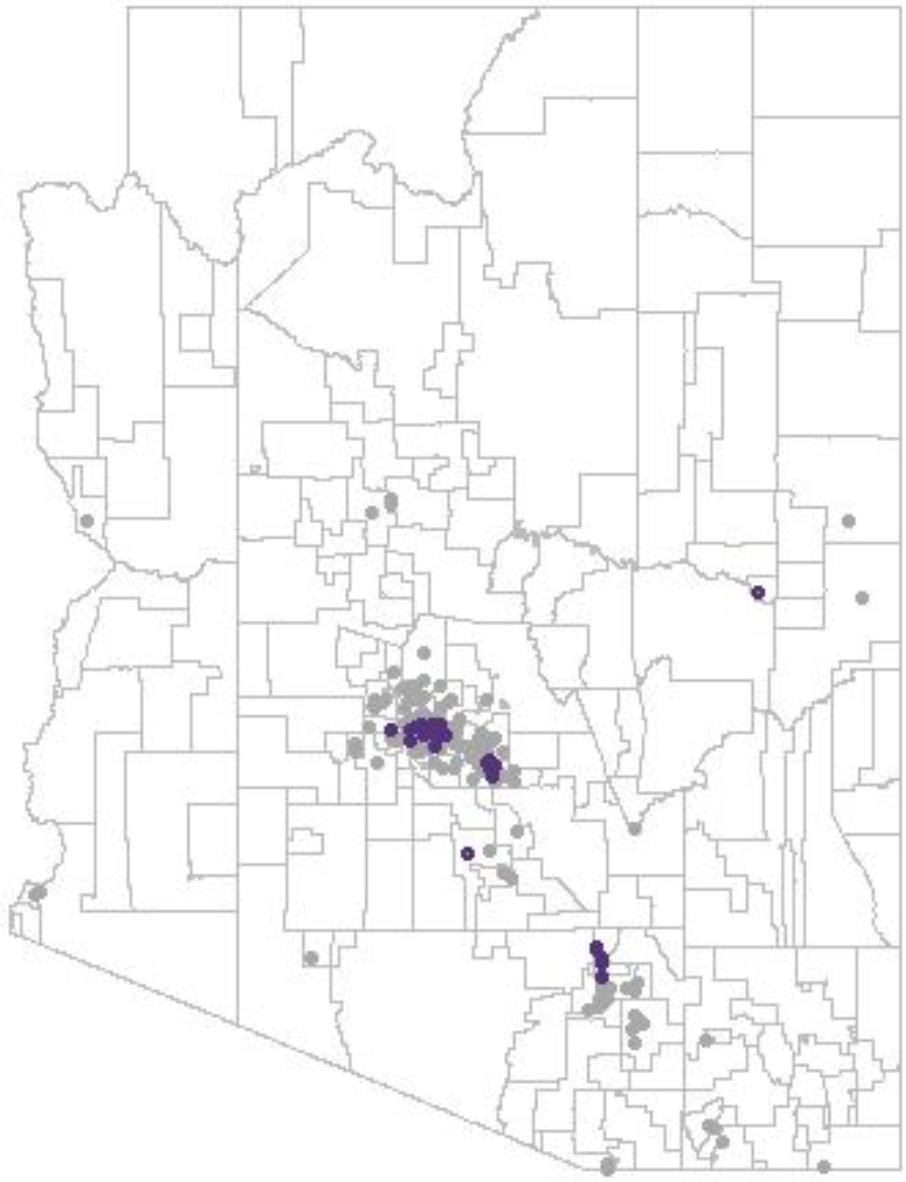


FIGURE 4. SCHOOLS IN THE ANALYTIC SAMPLE

Analysis

This study uses a quasi-experimental comparison group design to estimate the impact of ALEKS on the EOC assessments in Algebra I, Geometry, and Algebra II. The estimates are obtained by comparing the proportions of students in the various proficiency levels in courses in ALEKS schools and comparison schools, using linear adjustment for differences in student demographics, school characteristics, and previous year test performance. Pretest data at the student level was not available. Instead, we use prior year school-level outcomes in the same courses. Three approaches to the identification of the treatment group were explored.

1. Greater than 50% of students in a course took at least one ALEKS assessment (main analysis)
2. Courses with at least one ALEKS user and at least one assessment taken or topic attempted
3. Courses with an average of one or more assessments per student

Assessments were chosen as the focus of ALEKS usage due to their central tendency: while all usage metrics were highly correlated with each other, assessments taken had the highest average correlation with other usage metrics. The number of topics learned and topics retained are nearly perfectly correlated with the number of topics attempted (Table 2).

TABLE 2. CORRELATIONS BETWEEN ALEKS USAGE METRICs

	Logins	Total time	Assessments	Topics attempted
Logins	1	.86	.82	.78
Total time	.86	1	.81	.80
Assessments	.82	.81	1	.82
Topics attempted	.78	.80	.82	1

There is a tradeoff between the treatment definition and the sample size: design approach 1 and 3 single out “active users” (a stronger definition) but result in a smaller number of classes considered as treated (classes with some users but not passing the criteria are removed from the sample). Additionally, the outcome metrics are available for substantially different subsamples because of the data publication requirements; that is, the proportion of students performing at the lowest proficiency level are typically not available for higher-performing schools and vice versa. These results should be taken with caution since they come from a quasi-experimental study with non-equivalent groups. These estimates are conservative because we use passing rates and percent scoring at the lowest proficiency level, which may not be sensitive to achievement gains for the worst performing students. That is, these students may get higher scores but still remain on Level 1 - Minimally Proficient or below passing. Table 3 and Table 4 show the baseline equivalence of the ALEKS and comparison schools used in design approach 2 and 3, respectively.

TABLE 3. BASELINE EQUIVALENCE OF THE ALEKS AND COMPARISON SAMPLES, SAMPLE FOR DESIGN APPROACH 2

Characteristic	ALEKS	Comparison	Pooled standard deviation	Difference as proportion of standard deviation
Average school size	1366	881	701	.69
Percent charter schools	23	40	47	.37
Percent economically disadvantaged	56	49	28	.22
Percent White	30	41	26	.40
Percent Hispanic	53	44	27	.32
Percent Native American	6	5	18	.08

Note. Differences in the treatment and outcome groups were greater than .25 standard deviations. Based on WWC evidence standards, baseline equivalence was not achieved, as ALEKS schools tended to serve schools with a higher proportion of disadvantaged students.

TABLE 4. BASELINE EQUIVALENCE OF THE ALEKS AND COMPARISON SAMPLES, SAMPLE FOR DESIGN APPROACH 3

Characteristic	ALEKS	Comparison	Pooled standard deviation	Difference as proportion of standard deviation
Average school size	1324	1026	701	.44
Percent charter schools	24	35	47	.24
Percent economically disadvantaged	58	50	28	.29
Percent White	28	40	26	.45
Percent Hispanic	55	46	27	.35
Percent Native American	5	3	18	.09

Note. Differences in the treatment and outcome groups were greater than .25 standard deviations. Based on WWC evidence standards, baseline equivalence was not achieved, as ALEKS schools tended to serve schools with a higher proportion of disadvantaged students.

Results

Results for the three approaches described above are reported in Tables 5 through 7, respectively. The estimates of the average impact are in the same direction for all three approaches, although the estimates and statistical significance varies due to the user population sample sizes.

TABLE 5. EFFECT OF ALEKS ON THE PROPORTION OF STUDENTS PERFORMING AT VARIOUS PERFORMANCE LEVELS; DESIGN APPROACH 1, MAIN ANALYSIS

	Passing		Level 1 - Minimally Proficient		Level 4 - Highly Proficient	
Course	**Estimate**	***p value***	**Estimate**	***p value***	**Estimate**	***p value***
Algebra I	2.5	.25	-5.1	.05	4.2	.002
Geometry	-1.5	.21	1.7	.03	-0.8	.01
Algebra II	0.7	.39	-0.6	.08	0.04	.03

TABLE 6. EFFECT OF ALEKS ON THE PROPORTION OF STUDENTS PERFORMING AT VARIOUS PERFORMANCE LEVELS; DESIGN APPROACH 2

	Passing		Level 1 - Minimally Proficient		Level 4 - Highly Proficient	
Course	**Estimate**	***p value***	**Estimate**	***p value***	**Estimate**	***p value***
Algebra I	0.5	.80	-3.2	.07	1.0	.40
Geometry	0.3	.85	2.1	.06	-0.3	.40
Algebra II	3.0	.32	-1.5	.40	0.75	.88

TABLE 7. EFFECT OF ALEKS ON THE PROPORTION OF STUDENTS PERFORMING AT VARIOUS PERFORMANCE LEVELS; DESIGN APPROACH 3

	Passing		Level 1 - Minimally Proficient		Level 4 - Highly Proficient	
Course	**Estimate**	***p value***	**Estimate**	***p value***	**Estimate**	***p value***
Algebra I	2.3	.32	-5.0	.02	2.8	.03
Geometry	1.4	.65	1.9	.05	-0.4	.04
Algebra II	3.1	.39	-1.4	.07	0.2	.09

Note that these results only establish an association between course-level average usage and aggregate student outcomes. They cannot be used to predict the effect of an increase in ALEKS usage on individual students or infer an optimal level of use.