Measuring the Impact of IXL Math and IXL Language Arts in Smarter Balanced States

Introduction

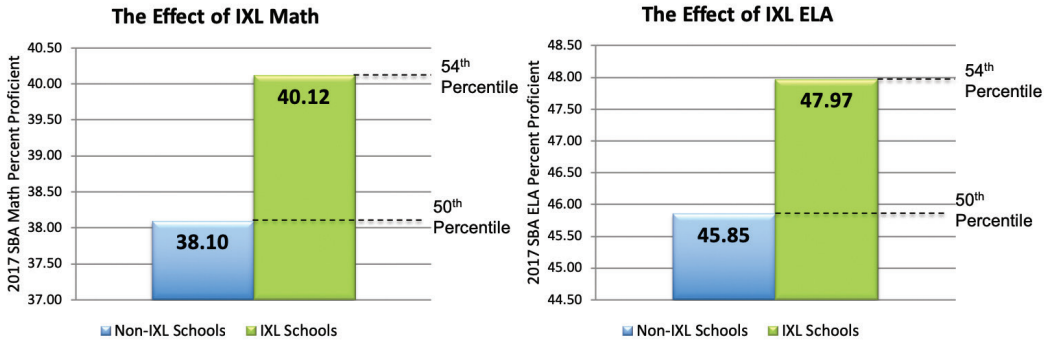
Previous research has shown that the use of IXL has a significant impact on student achievement for an individual school (Empirical Education, 2013). In this study, we explore IXL usage across 10 states that have adopted the Smarter Balanced Assessments: California, Connecticut, Hawaii, Idaho, Michigan, Nevada, Oregon, South Dakota, Vermont, and Washington. Examining such a large sample of schools allows us to quantify the impact of IXL Math and IXL English Language Arts (ELA) on school performance as measured by the Smarter Balanced Assessments (SBA).

Abstract

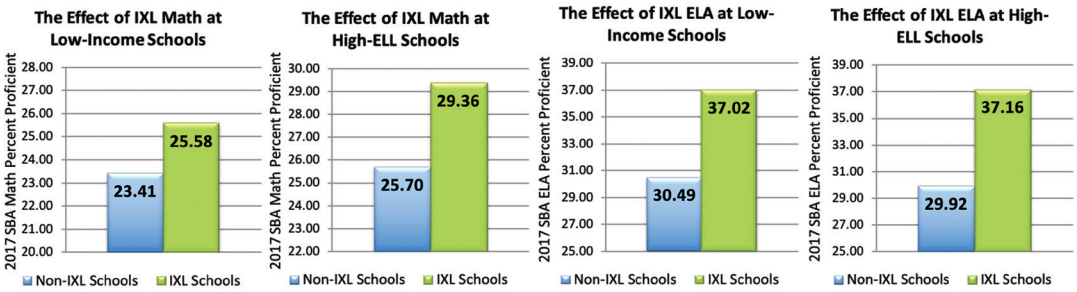
This study investigated thousands of public schools in 10 Smarter Balanced states that used IXL Math or IXL ELA between 2016 and 2017. Using data from the 2017 Smarter Balanced Assessments, researchers examined student achievement in both IXL schools and non-IXL schools. Scores from the 2016 SBA were used to control for schools' performance prior to using IXL. IXL usage by the schools in this study ranged from less than one minute per student, per week, to over 80 minutes per student, per week. Even with the wide range in student usage, our researchers found a strong positive correlation between IXL usage and school performance. These results are statistically significant.

Key Findings

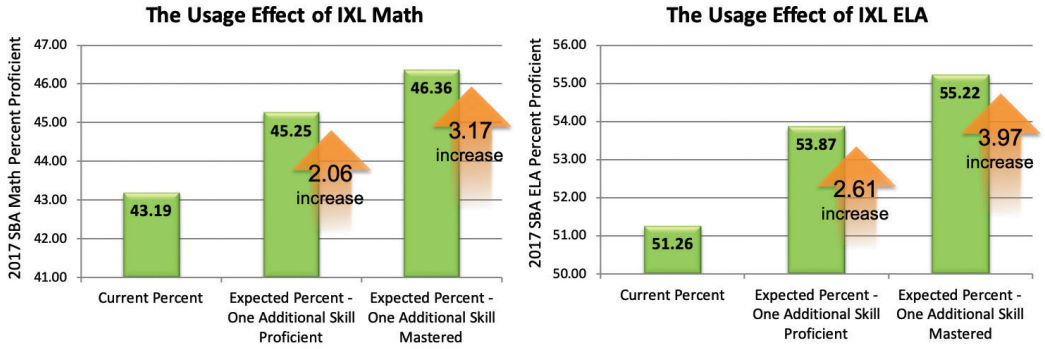
Schools using IXL outperformed schools without IXL on the SBA in both math and ELA.



The IXL effect was even larger at low-income schools and schools with a high percentage of English language learners (ELLs).



Practice makes perfect. If every student achieved proficiency on one additional IXL skill per week, the school's proficiency rate on the SBA would increase by 2.06 points in math and 2.61 points in ELA. If every student mastered one additional skill per week, the school's proficiency rate would increase by 3.17 points in math and 3.97 points in ELA.



The IXL Effect in Smarter Balanced States

SEPTEMBER 20, 2018

Study Design

Our researchers wanted to determine the effect of IXL on student achievement at the school level, as measured by the percentage of students in the school meeting proficiency goals set by the state. To do this, we looked at state test results for schools both before and after implementing IXL. We used schools not implementing IXL as a control.

This study used a pretest-posttest control group design (see Figure 1) to measure the impact of IXL. This type of study design evaluates the treatment effect by comparing the performance of the treatment group and the control group on the posttest, after adjusting for their performance on the pretest. The treatment group included schools that started using IXL in the 2016-17 school year. The control group consisted of schools that did not use IXL in the 2015-16 or 2016-17 school years.

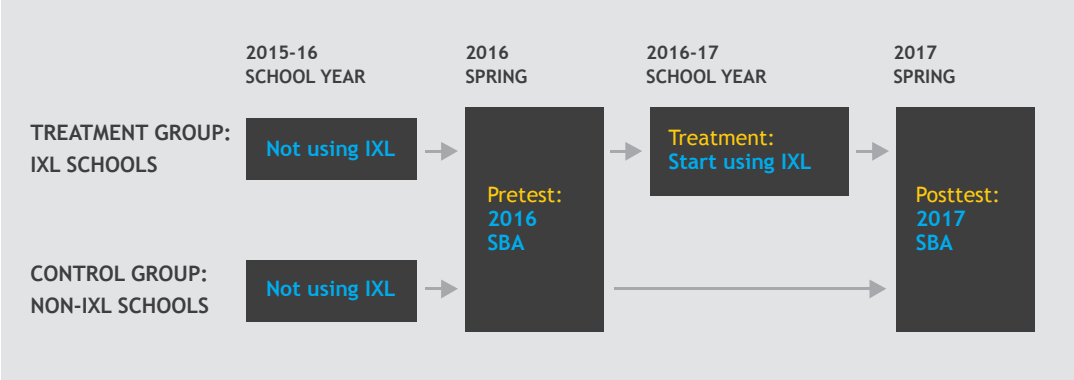


Figure 1. Study Design for IXL Effect

The Smarter Balanced Assessments (SBA) were used as the pretest and posttest to determine performance for all schools. The SBA are aligned to the Common Core Standards and are designed to determine students' progress toward college and career readiness in English language arts/literacy and math. They are the mandatory state assessments given to students in grades 3-8 and in grade 11 in California, Connecticut, Hawaii, Idaho, Michigan[1], Nevada, Oregon, South Dakota, Vermont, and Washington[2]. The academic performance of each grade level at each school is evaluated based on the percentage of students who met or exceeded the achievement standard (referred to as "percent proficient").

Methodology

The study analyzed data from 17,390 public schools, including both traditional public schools and charter schools. A total of 2,958 public schools used IXL Math and/or IXL ELA during the 2016-17 school year. As the number of students who used IXL ranged from a single classroom to the entire school, this study defined a school as an "IXL school" at each grade level rather than the school level. A grade level cohort is identified as an IXL school if at least 70 percent of the students enrolled in the grade level practiced on IXL (see Appendix A for details on school selection and classification). Based on this criteria, 1,135 grade level cohorts from 536 schools were identified as IXL schools for IXL Math, and 578 grade level cohorts from 301 schools were identified as IXL schools for IXL ELA. Appendix B shows the characteristics of IXL schools and the state averages. The school performance and enrollment data were obtained from the state department of education websites and the Institute of Education Sciences.

[1] *In Michigan, the SBA are only given to students in grades 3-8.*

[2] *Since SBA results for Delaware and Montana were not publicly available when this study was conducted, these states are not included in the analysis.*

Our researchers used multilevel linear models to calculate the IXL effect—i.e., the performance difference between IXL schools and non-IXL schools on the 2017 SBA, controlling for factors such as prior performance, school size, percentage of English language learners (ELL), percentage of economically disadvantaged students, and school location. Similar multilevel linear models were applied to elementary school levels (i.e., grades 3-5), middle and high school levels (i.e., grades 6-8 and 11), low-income schools (i.e., schools with at least 75 percent economically disadvantaged students), and high-ELL schools (i.e., schools with at least 30 percent ELL students). Another set of multilevel linear models was applied to estimate the strength of association between IXL usage and school performance, and to compare the performance difference between non-IXL schools and IXL schools with different amounts of IXL usage. (See Appendix C for a detailed explanation of analytical methods.)

This form of analysis allowed us to answer three key questions:

1. What is the IXL effect on student achievement? In other words, did IXL schools perform better on the 2017 Smarter Balanced Assessments than non-IXL schools?
2. What is the IXL effect for elementary schools, middle and high schools, low-income schools, and high-ELL schools?
3. What is the association between IXL usage and school performance?

Results

Analysis of the data showed that the use of IXL had positive and statistically significant effects on school performance on the SBA in both math and ELA, indicating there is a high probability that similar schools using IXL would achieve similar results. The IXL effect was even larger for low-income schools and high-ELL schools. Our analysis also showed a positive correlation between IXL usage and school performance. In particular, on the 2017 SBA, IXL schools with at least two skills mastered per student, per month, outperformed IXL schools with fewer skills mastered. One additional skill mastered per student, per week, was associated with an expected 3.17 percent increase on a school's percent proficient in math and a 3.97 percent increase in ELA.

The Efficacy of IXL Math

The implementation of IXL Math showed a statistically significant effect on schools' performance on the 2017 Smarter Balanced math assessment across grades 3 through 8 and grade 11 (see Appendix D, Table D1 for details).

Figure 2 shows that the adjusted percent proficient[3] was 38.10 for non-IXL schools and 40.12 for IXL schools. The 2.02 percent difference corresponds to a percentile gain of 4 points in school ranking. That is, if an average non-IXL school (at the 50th percentile) had begun using IXL Math in the 2016-17 school year, the school's percent proficient would be expected to increase 2.02 percent, putting the school at the 54th percentile.

[3] *Adjusted percent proficient: the percentage of students who reached the proficiency level on the SBA, after adjusting for differences in prior performance and school characteristics between IXL schools and non-IXL schools.*

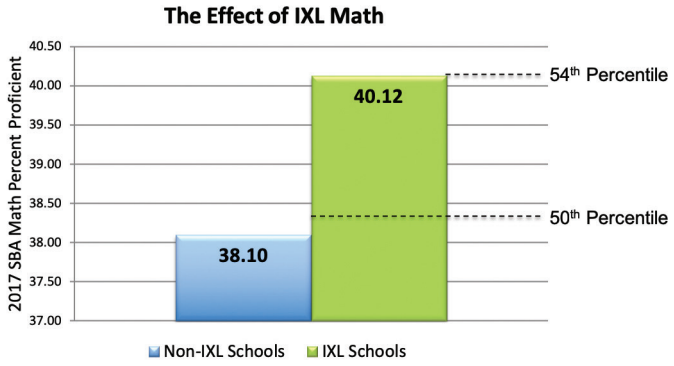


Figure 2. The Effect of IXL Math on the 2017 Smarter Balanced Math Assessment

Figure 3 shows the effect of IXL Math at the elementary school level (i.e., grades 3-5) and at the middle and high school level (i.e., grades 6-8 and 11). For elementary schools, the IXL effect is 1.74 points, corresponding to a 3-point percentile gain. For middle and high schools, the IXL effect is 2.85 points, corresponding to a 5-point percentile gain.

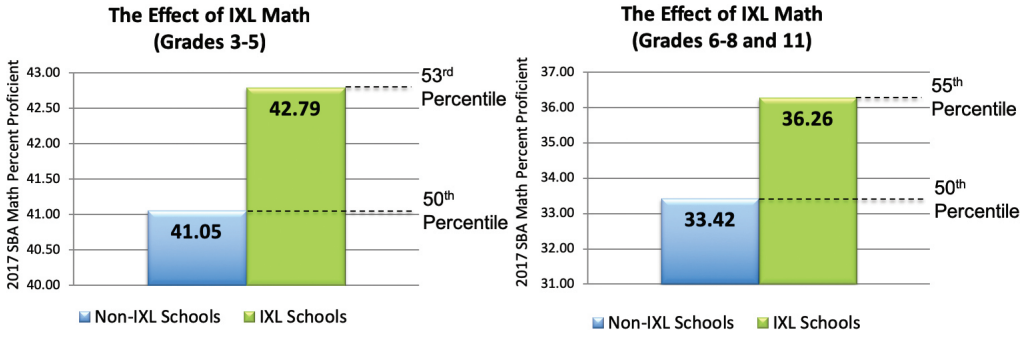


Figure 3. The Effect of IXL Math at Elementary and Middle/High School Levels

Figure 4 shows the effect of IXL Math at low-income schools and high-ELL schools. For low-income schools, the IXL effect is 2.17 points, corresponding to a 6-point percentile gain. For high-ELL schools, the IXL effect is 3.67 points, corresponding to a 9-point percentile gain.

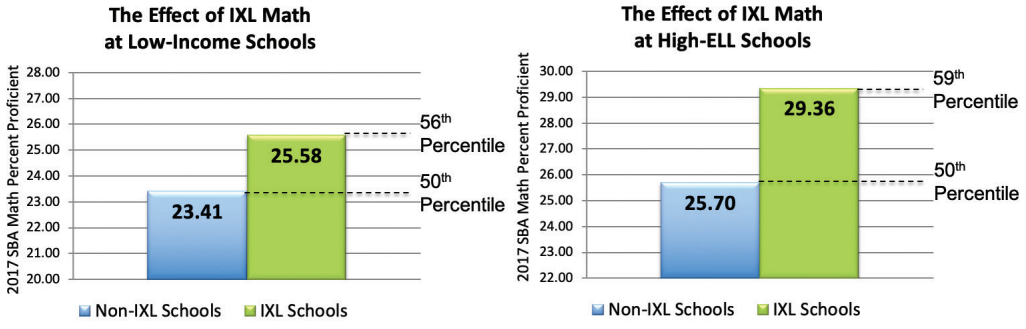


Figure 4. The Effect of IXL Math at Low-Income Schools and High-ELL Schools

Note: The 50th percentile in Figure 4 refers to the 50th percentile among low-income schools or high-ELL schools.

The Efficacy of IXL ELA

The implementation of IXL ELA also showed a statistically significant effect on schools' performance on the 2017 Smarter Balanced ELA assessment across grades 3 through 8 and grade 11 (see Appendix D, Table D2 for details).

Figure 5 shows that the adjusted percent proficient was 45.85 for non-IXL schools and 47.97 for IXL schools. The 2.12 percent difference corresponds to a percentile gain of 4 points in school ranking. That is, if an average non-IXL school (at the 50th percentile) had begun using IXL ELA in the 2016-17 school year, the school's percent proficient would be expected to increase 2.12 percent, putting the school at the 54th percentile.

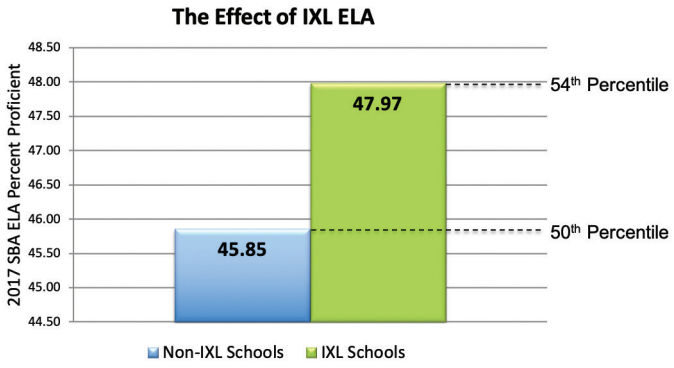


Figure 5. The Effect of IXL ELA on the 2017 Smarter Balanced ELA Assessment

Figure 6 shows the effect of IXL ELA at the elementary school level (i.e., grades 3-5) and at the middle and high school level (i.e., grades 6-8 and 11). For elementary schools, the IXL effect is 2.08 points, corresponding to a 4-point percentile gain. For middle schools, the IXL effect is 2.87 points, corresponding to a 5-point percentile gain.

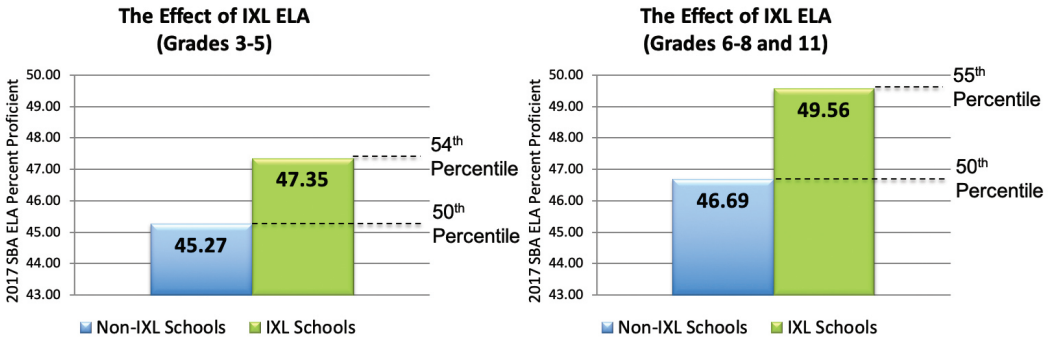


Figure 6. The Effect of IXL ELA at Elementary and Middle/High School Levels

Figure 7 shows the effect of IXL ELA at low-income schools and high-ELL schools. For low-income schools, the IXL effect is 6.53 points, corresponding to a 17-point percentile gain. For high-ELL schools, the IXL effect is 7.24 points, corresponding to a 19-point percentile gain.

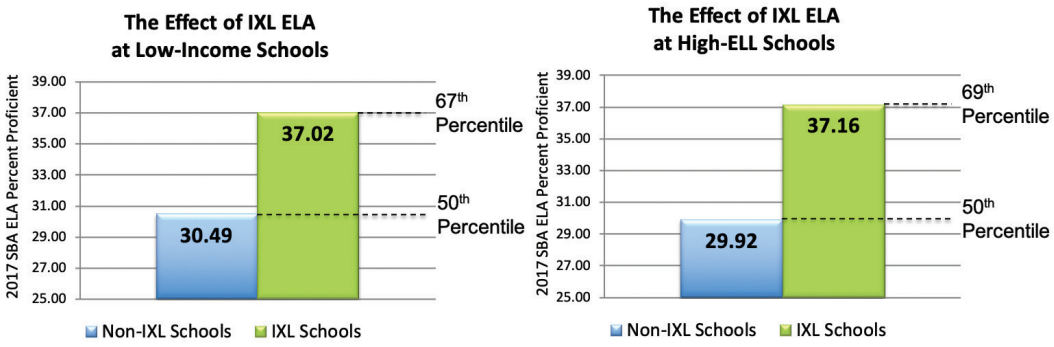


Figure 7. The Effect of IXL ELA at Low-Income Schools and High-ELL Schools

Note: The 50th percentile in Figure 7 refers to the 50th percentile among low-income schools or high-ELL schools.

The Usage Effect of IXL Math

For IXL schools that used IXL Math for one school year in 2016-17, our analyses found a positive and statistically significant association between IXL Math usage and schools' performance on the 2017 Smarter Balanced math assessment (see Appendix D, Table D3 for details).

Figure 8 shows the adjusted percent proficient for non-IXL schools and for IXL schools with different amounts of IXL Math usage. IXL schools with at least one math skill proficient[4] per student, per week, had 3.26 percent more students reaching the proficiency level on the 2017 Smarter Balanced math assessment, corresponding to a 6-point percentile gain.

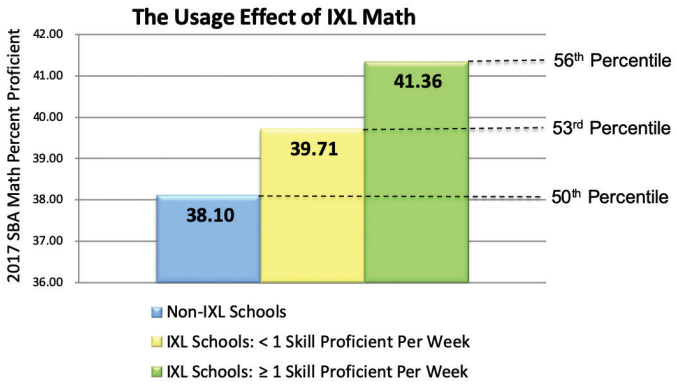


Figure 8. The Usage Effect of IXL Math with Different Usage Levels

[4] Throughout IXL, student progress is measured by the program's proprietary SmartScore. The SmartScore starts at 0, increases as students answer questions correctly, and decreases if questions are answered incorrectly. A student is considered proficient in a skill when they reach a SmartScore of 80.

As shown in Figure 9, for IXL schools that used IXL Math, if every student achieved proficiency on one additional IXL Math skill every week, the school could expect 2.06 percent more students to reach the proficiency level on the 2017 Smarter Balanced math assessment. If every student mastered[5] one additional IXL Math skill every week, the school could expect 3.17 percent more students to reach the proficiency level on the 2017 Smarter Balanced math assessment.

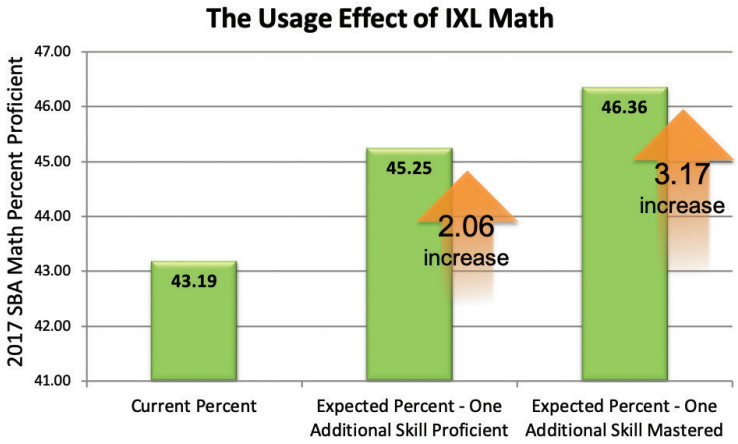


Figure 9. The Usage Effect of IXL Math

The Usage Effect of IXL ELA

For IXL schools that used IXL ELA for one school year in 2016-17, our analyses also found a positive and statistically significant association between IXL ELA usage and schools' performance on the 2017 Smarter Balanced ELA assessment (see Appendix D, Table D3 for details).

Figure 10 shows the adjusted percent proficient for non-IXL schools, and for IXL schools with different amounts of usage on IXL ELA. IXL schools with at least one ELA skill proficient per student every other week had 3.05 percent more students reaching the proficiency level on the 2017 Smarter Balanced ELA assessment, corresponding to a 6-point percentile gain.

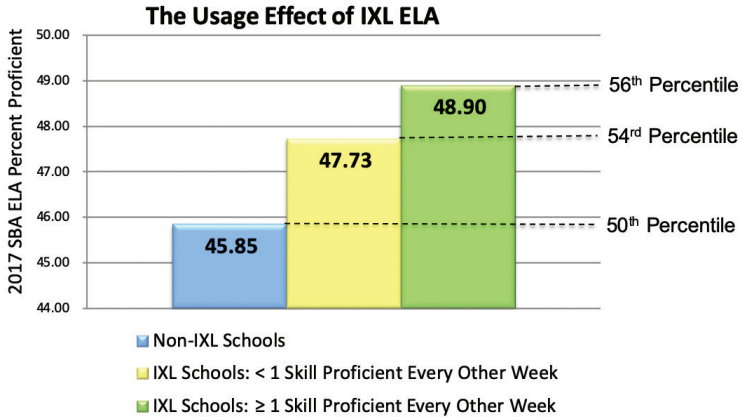


Figure 10. The Usage Effect of IXL ELA with Different Usage Levels

[5] *A student is considered to have mastered a skill when they reach a SmartScore of 100.*

As shown in Figure 11, for IXL schools that used IXL ELA, if every student achieved proficiency on one additional IXL ELA skill every week, the school could expect 2.61 percent more students to reach the proficiency level on the 2017 Smarter Balanced ELA assessment. If every student mastered one additional IXL ELA skill every week, the school could expect 3.96 percent more students to reach the proficiency level on the 2017 Smarter Balanced ELA assessment.

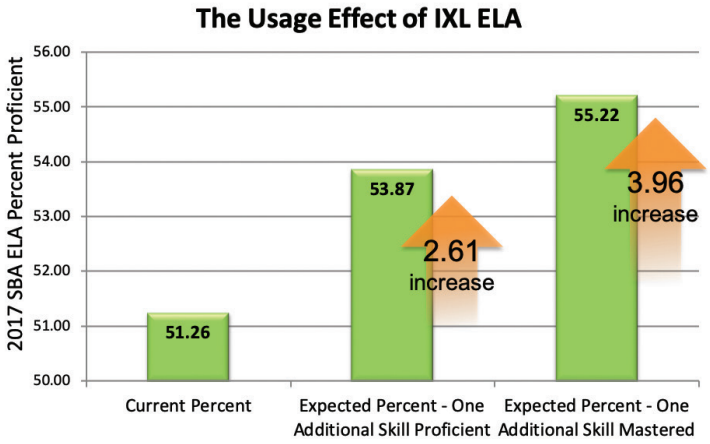


Figure 11. The Usage Effect of IXL ELA

References

Empirical Education (2013). A Study of Student Achievement, Teacher Perceptions, and IXL Math. Retrieved from https://www.ixl.com/research/IXL-Research-Study-2013.pdf

What Works Clearinghouse (2014). What Works Clearinghouse procedures and standards handbook (Version 3.0). Retrieved from http://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_procedures_v3_0_standards_handbook.pdf

Appendix A: IXL School Identification

This study determined whether a school is an IXL school based only on the number of students using IXL. Because a school may choose to use IXL in only a few classrooms or across the entire school, this study defined IXL schools at each testing grade level[6] rather than the school level. The group of students at the same grade level within the same school is referred to as a grade level cohort.

A school is identified as an IXL school for a certain grade level in a certain school year if: 1) the school has an active IXL account within the school year, and 2) at least 70 percent of the enrolled students at this grade level have practiced on IXL within the school year.

A school is identified as a non-IXL school for a certain grade level in a certain school year if no students at this grade level have practiced on IXL within this school year.

[6] *Testing grade level: a grade level in which students are required to take the Smarter Balanced Assessments.*

For example, suppose a K-6 school had an active IXL account within the 2016-17 school year, and over 70 percent of students in grades K-4 had practiced on IXL. Less than 70 percent of students in grades 5 and 6 practiced on IXL during that year. This school would be defined as an IXL school for the 3rd and 4th grade level cohorts and as a non-IXL school for the 5th and 6th grade level cohorts. Students in grades K-2 are excluded from the analysis because they do not take the state standardized tests.

Appendix B: Schools' Background Information

Table B1 shows the background information for all public schools in 10 Smarter Balanced states (i.e., California, Connecticut, Hawaii, Idaho, Michigan, Nevada, Oregon, South Dakota, Vermont, and Washington) and for IXL schools. IXL schools performed slightly better than the state average on the Smarter Balanced math tests in 2016 and 2017.

Table B1. Background Information for Smarter Balanced states and IXL schools

	State average	IXL schools	
		IXL Math	IXL ELA
Number of schools	17,390	536	301
Number of grade level cohorts	52,789	1135	578
2016 SBA math percent proficient	39%	42%	-
2017 SBA math percent proficient	40%	43%	-
2016 SBA ELA percent proficient	50%	-	50%
2017 SBA ELA percent proficient	49%	-	51%
% of economically disadvantaged students	52%	51%	51%
% of students with limited English proficiency	16%	17%	15%
% of schools in cities	32%	30%	22%
% of schools in suburbs	36%	36%	33%
% of schools in towns	12%	13%	14%
% of schools in rural areas	21%	21%	31%

Appendix C: Analytical Methods

A three-level linear model was used to calculate the IXL effect on Smarter Balanced assessment performance (i.e., the performance difference between IXL schools and non-IXL schools on the 2017 Smarter Balanced Assessments), after adjusting for schools' prior academic performance (i.e., 2016 Smarter Balanced Assessments percent proficient), cohort size (i.e., the number of enrolled students in the grade level cohort), school size (i.e., the number of enrolled students in the school), percentage of economically disadvantaged students, percentage of students with limited English proficiency, and school location (i.e., city, suburb, town, or rural as defined by the Institute of Education Sciences). The units of analysis of the three-level model are grade level cohorts (i.e., level 1). Grade level cohorts are nested within school districts (i.e., level 2), which are further nested within states (i.e., level 3). Similar multilevel linear models were applied to the low-income grade level cohorts only (i.e., cohorts with at least 75 percent economically disadvantaged students) and high-ELL grade level cohorts only (i.e., cohorts with at least 30 percent English language learners) to calculate the IXL effect on these two types of schools separately. To assist in the interpretation of the IXL effect, we reported statistical significance, effect size, and percentile gain. Statistical significance, also referred to as *p*-value, is the probability that the IXL effect is zero. A small *p*-value (e.g., less than 0.05) indicates strong evidence that the IXL effect is not zero. Effect size is the mean difference in standard deviation units and is known as Hedges' *g*. In this study, effect size is computed using adjusted mean and unadjusted standard deviations. Percentile gain is the expected change in percentile rank for an average non-IXL school if the school had used IXL. It is calculated based on the effect size. More details about these analytical methods can be found in What Works Clearinghouse (2014).

We applied another set of three-level linear models to compare the performance difference between non-IXL school and IXL schools with different amounts of IXL usage (i.e., fewer than or at least one skill proficient per student every week for IXL Math, and fewer than or at least one skill proficient per student every other week for IXL ELA). These models were very similar to the first model described in this appendix, but the model included the IXL usage group (i.e., fewer than or at least one skill proficient per student every week for IXL Math, and fewer than or at least one skill proficient per student every other week for IXL ELA) as an independent variable and the sample only included IXL schools.

Another set of three-level linear models was used to estimate the strength of association between IXL usage and school performance. This model was also similar to the first model described above, but this model included the IXL usage as an independent variable and the sample only included IXL schools. The IXL usage in this study was measured by the average number of skills in which students achieved proficiency every week and the average number of skills each student mastered every week.

Appendix D: Data Tables

Table D1. The Effect of IXL Math on the 2017 SBA (Math)

Values	Overall (all schools across grades 3-8 and 11)	ES level (grades 3-5)	MS-HS level (grades 6-8 and 11)	Low-income schools	High-ELL schools
Number of grade level cohorts at IXL schools	1,135	727	408	291	209
Number of grade level cohorts at non-IXL schools	43,481	26,898	16,583	14,404	10,388
The IXL effect	2.02***	1.74***	2.85***	2.17	3.67
Effect size	0.09	0.08	0.14	0.15	0.23
Percentile gain	3.75	3.22	5.46	5.93	9.20
Adjusted 2017 SBA math percent proficient for IXL schools	40.12%	42.79%	36.26%	25.58%	29.36%
Adjusted 2017 SBA math percent proficient for non-IXL schools	38.10%	41.05%	33.42%	23.41%	25.70%

*Note: 1) *: significant at .05 level; **: significant at .01 level 2) ES: elementary school; MS: middle school*

Table D2. The Effect of IXL ELA on the 2017 SBA (ELA)

Values	Overall (all schools across grades 3-8 and 11)	ES level (grades 3-5)	MS-HS level (grades 6-8 and 11)	Low-income schools	High-ELL schools
Number of grade level cohorts at IXL schools	578	368	210	151	100
Number of grade level cohorts at non-IXL schools	46,822	29,257	17,565	15,110	10,871
The IXL effect	2.12***	2.08***	2.87*	6.53*	7.24*
Effect size	0.10	0.10	0.14	0.45	0.49
Percentile gain	4.13	4.11	5.48	17.23	18.85
Adjusted 2017 SBA ELA percent proficient for IXL schools	47.97%	47.35%	49.56%	37.02%	37.16%
Adjusted 2017 SBA ELA percent proficient for non-IXL schools	45.85%	45.27%	46.69%	30.49%	29.92%

*Note: 1) ***: significant at .001 level; *: significant at .05 level*
2) ES: elementary school; MS: middle school; HS: high school

Table D3. The Usage Effect of IXL Math and ELA

Values	IXL Math		IXL ELA	
	< 1 skill proficient	≥ 1 skill proficient	< 1 skill proficient	≥ 1 skill proficient
Number of grade level cohorts at IXL schools	936	199	457	121
Number of grade level cohorts at non-IXL schools	43,481		46,822	
The IXL effect	1.61***	3.26***	1.88***	3.05***
Effect size	0.07	0.15	0.09	0.15
Percentile gain	2.98	6.01	3.67	5.92
Adjusted 2017 SBA math percent proficient for IXL schools	39.71%	41.36%	47.73%	48.90%
Adjusted 2017 SBA math percent proficient for non-IXL schools	38.10%		45.85%	

*Note: ***: significant at .001 level*