RESEARCH REPORT

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Measuring the Impact of IXL Math and IXL Language Arts in Kentucky Schools

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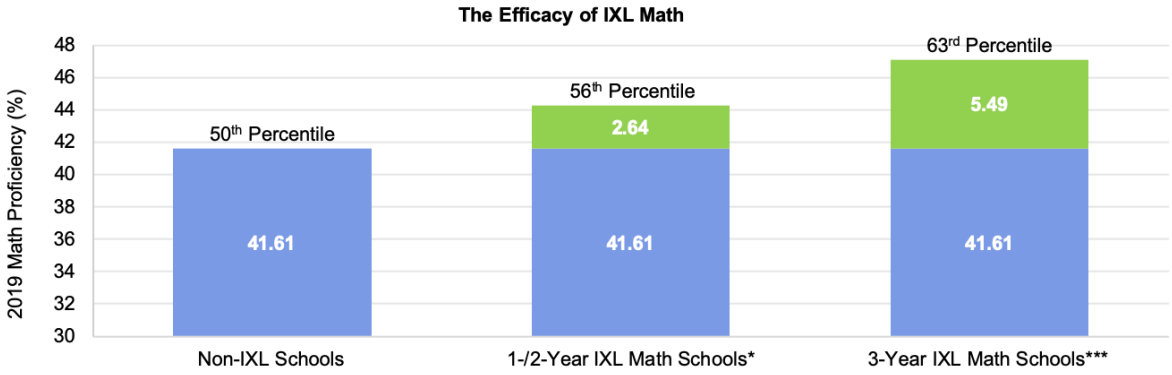
Executive Summary

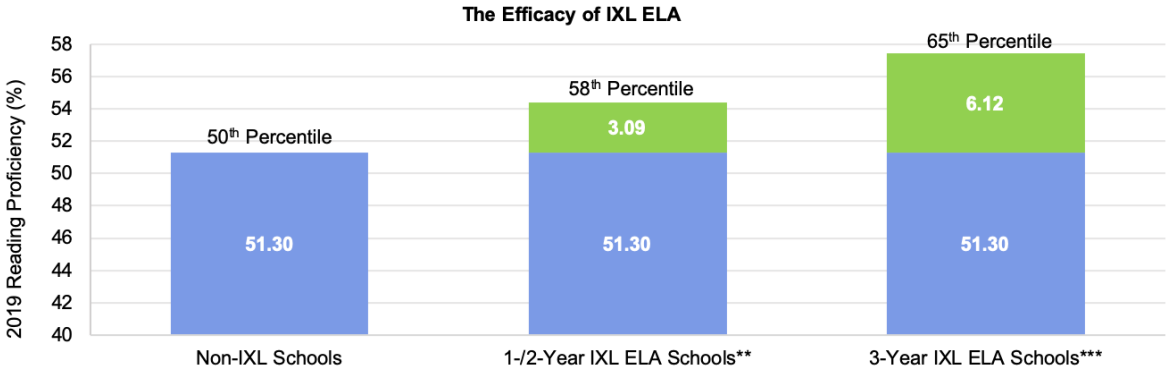
IXL is a personalized learning platform designed to help students build academic skills in subjects including but not limited to math and English language arts (ELA). Previous research has shown that IXL can have a significant impact on academic performance in schools or districts (e.g., Empirical Education, 2013).

To further evaluate the impact of IXL on learning outcomes in math and reading, IXL researchers conducted a study using a quasi-experimental design and analyzed data from 1,507 public schools across the state of Kentucky, among which, 427 schools had adopted IXL Math and/or IXL ELA during the 2016-17, 2017-18, and/or 2018-19 school years. IXL usage by these schools ranged from less than one minute per student per week, to over 70 minutes per student per week. Even with a wide range in student usage, we found positive and statistically significant effects of IXL usage, as measured by the Kentucky Performance Rating for Educational Progress (K-PREP) tests. Key findings include[1]:

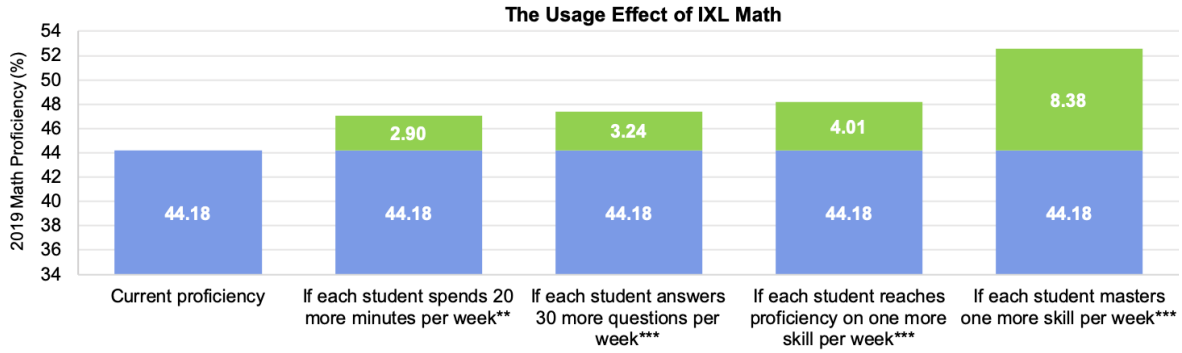
- **IXL has positive effects on school performance.** Kentucky schools that used IXL outperformed schools that did not use IXL. The longer the schools used IXL, the better they performed.

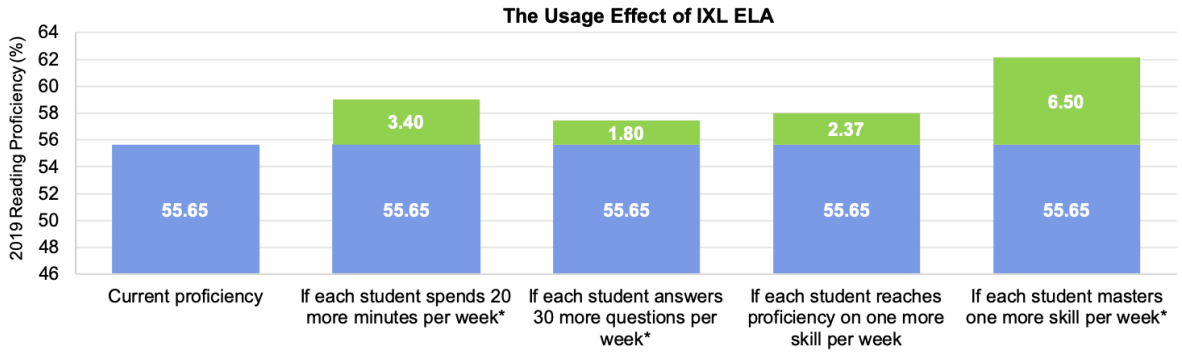


[1] *In all figures: * indicates significance at the .05 level; ** indicates significance at the .01 level; *** indicates significance at the .001 level.*



- **More IXL usage is associated with higher achievement.** Schools that adopted IXL products performed better in corresponding assessments when their students: spent more time on IXL, answered more questions on IXL, reached proficiency in and/or mastered more skills on IXL.





Measuring the Impact of IXL Math and IXL ELA in Kentucky Schools

Study Design

The purpose of this study was to evaluate the impact of IXL on student achievement in math and reading at the school level, as measured by the percentage of students in the school meeting academic proficiency goals set by the state. Different IXL implementation patterns in the 2016-17, 2017-18, and 2018-19 school years allowed IXL researchers to examine the impact of IXL. The study adopted a quasi-experimental pretest-posttest control group design, which evaluates the treatment effect by comparing the performance of the treatment group (IXL schools) and the control group (non-IXL schools) at posttest, after accounting for their pretest performance as well as demographic background.

For IXL Math and IXL ELA, the treatment group (IXL schools) included schools that used IXL during the 2016-19 school years. Based on the duration of IXL implementation, the treatment group consisted of short-term IXL schools (i.e., schools that implemented IXL for one or two years) and long-term IXL schools (i.e., schools that implemented IXL for three years). The control group (i.e., non-IXL schools) consisted of schools that did not use IXL at any time during these school years. The study design is summarized visually in Figure 1.

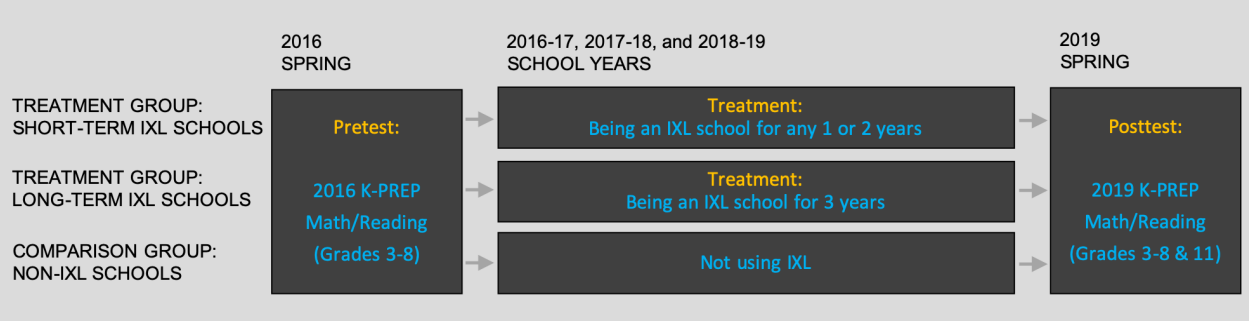


Figure 1. Study Design

School performance was measured by the Kentucky Performance Rating for Educational Progress (K-PREP) tests. In the spring of 2016 and spring of 2017, K-PREP Math and K-PREP Reading were administered to students in grades 3-8. In the spring of 2018 and spring of 2019, K-PREP Math and K-PREP Reading were administered to students in grades 3-8 and grade 11. For a certain school year, if more than twenty percent[2] of the students who were tested by K-PREP were using the corresponding IXL product, then the school was defined as an "IXL school" for that year. By this definition, there were 264 IXL Math schools and 206 IXL ELA schools in total during any of the 2016-17, 2017-18 and 2018-19 school years.

[2] We adopted this minimum user percent to exclude schools with a very small proportion of IXL users from the treatment group. Meanwhile, we adopted this relatively low number of users as the cutoff, in order to maximize the generalizability of the present study.

Methodology

Two sources of data were used in this study: IXL usage data and school performance data. IXL usage data were retrieved from IXL Learning's database, which provided information on whether a school had adopted a certain IXL product (e.g., IXL Math; IXL ELA) during a certain school year. For each subject in a given school year, IXL usage data also provided information on the amount of time spent on IXL, the number of questions answered, the number of skills in which students reached proficiency, and the number of skills mastered[3]. The average usage per student per week was calculated for each school across each school year. Students in IXL schools practiced on IXL Math for about 16 minutes answering about 38 questions per week, on average. Students practiced on IXL ELA for about 9 minutes answering about 25 questions per week, on average. See Table 1 for more details about IXL usage among IXL schools.

Table 1. IXL Math and IXL ELA Usage

IXL usage (per student per week)	IXL Math schools (*n* = 264)				IXL ELA schools (*n* = 206)			
	M	*SD*	Min	Max	*M*	*SD*	Min	Max
Time spent (in minutes)	16.37	11.44	0.87	73.69	8.70	7.06	0.70	49.51
Questions answered	38.37	21.69	2.32	119.09	25.10	17.96	2.84	122.47
Skills proficient	0.86	0.53	0.06	3.22	0.45	0.40	0.03	3.91
Skills mastered	0.49	0.30	0.02	1.67	0.23	0.17	0.01	1.10

The school performance data and demographic information were obtained from the Kentucky Department of Education. Schools' proficiency rates from the 2019 K-PREP school report card were used as the posttest. Proficiency rates from the 2016 K-PREP report card were used as the pretest to control for schools' baseline performance prior to using IXL. See Appendix A for details on proficiency rates and demographic information.

[3] IXL uses its proprietary SmartScore to measure student progress on a skill. SmartScores range from 0 to 100 and are calculated based on a number of metrics, including answer accuracy, question difficulty, and response pattern consistency. Students reach proficiency with a SmartScore of 80 and mastery with a SmartScore of 100.

Research Questions

The present study aimed to answer two research questions, for math and reading, respectively:

1. **Overall efficacy of IXL:** Did IXL schools outperform non-IXL schools on state assessments?

2. **Usage effect of IXL:** Among IXL schools[4], was greater IXL usage associated with better performance on state assessments?

Analysis

To examine IXL efficacy (research question 1), multiple linear regression models were used for math and reading separately. IXL adoption was used to predict 2019 K-PREP performance, controlling for 2016 K-PREP performance, as well as demographic background variables including school location (i.e., city, suburb, town, or rural), school size, percentage of students with disabilities, percentage of economically disadvantaged students, and percentage of English language learners (in the models for reading).

To determine the IXL usage effect (research question 2), only IXL schools were included in the analysis, using similar regression models as the ones described above. The four IXL usage indicators (i.e., amount of time spent, number of questions answered, number of skills proficient, and number of skills mastered) were used to predict 2019 K-PREP performance, controlling for 2016 K-PREP performance as well as demographic background variables. To avoid multicollinearity issues, the four indicators were examined one at a time.

Following What Works Clearinghouse (2020) guidelines, each effect is accompanied by a test of statistical significance and a probability (*p*) value. The *p*-value is the probability of observing the current or more extreme data, assuming the effect is zero (Cohen, 1994). As such, the smaller the *p*-value, the less likely it is the result occurred at random, with .05, .01, and .001 commonly used as thresholds in research practice. Effects associated with *p*-values smaller than these thresholds are considered statistically significant at each of these significance levels.

[4] When testing this question, a more inclusive definition of "IXL school" was used to cover more schools – if at least one student who was tested by K-PREP was using the corresponding IXL product in that year, the school was defined as an "IXL school" and included in the analysis.

Results

The Overall Efficacy of IXL Math

IXL Math adoption had a positive and statistically significant effect on school performance on K-PREP Math (F [9,929] = 202.60, p < .001). Recall that this model included one- or two-year short-term implementation as well as three-year long-term implementation indicators as predictors of 2019 K-PREP math performance, controlling for 2016 K-PREP math performance and demographic background variables. This model explained 66% of the variability in 2019 K-PREP proficiency rates. See Appendix B, Table B1 for detailed results.

One- or two-year IXL Math adoption had an unstandardized coefficient of 2.64 (p = .012; Cohen's d = .15), while three-year IXL Math adoption had an unstandardized coefficient of 5.49 (p < .001; Cohen's d = .32). That is, if an average non-IXL school at the 50th percentile had used IXL Math for one or two school years, the school could expect its math proficiency rate to increase by 2.64 percentage points, putting the school at the 56th percentile. If an average non-IXL school had used IXL Math for three school years, the school could expect its math proficiency rate to increase by 5.49 percentage points and rank at the 63rd percentile (see Fig. 2).

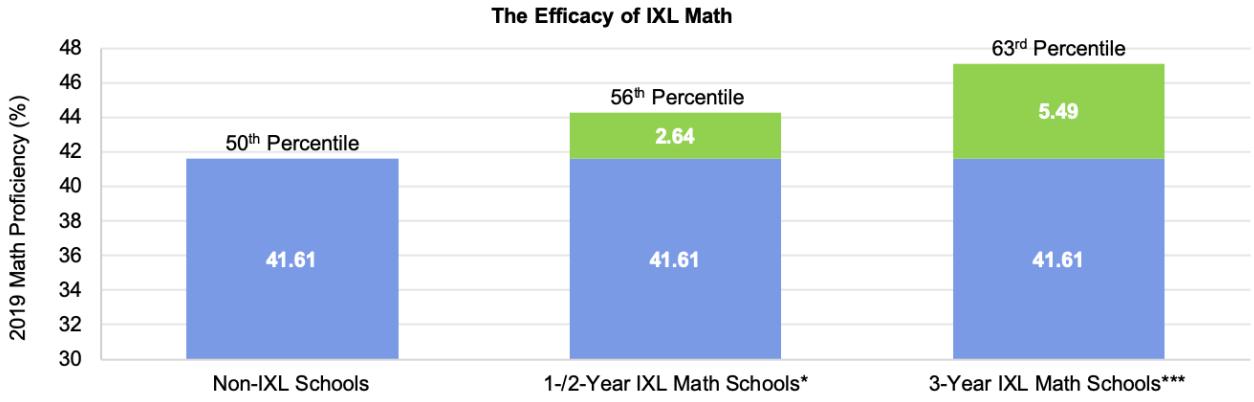


Figure 2. The Overall Efficacy of IXL Math

The Usage Effect of IXL Math

Using data from 264 IXL Math schools, we also examined the IXL Math usage effect. The four IXL Math usage indicators (i.e., amount of time spent, number of questions answered, number of skills proficient, and number of skills mastered) were added into the model separately and exclusively, resulting in four models. Results showed positive associations between all four IXL Math usage indicators and schools' math proficiency rates, with p values < .01. See Appendix C, Table C1 for detailed results.

Specifically, for an average school, for each additional minute spent on IXL per student per week, the math proficiency rate would increase by .15 percentage points. For example, if each student spent 20 additional minutes per week on IXL, the math proficiency rate would increase by about 2.90 percentage points. For each additional question answered per student per week, the math proficiency rate would increase by .11 percentage points. For example, if each student answered 30 additional questions per week, the math proficiency rate would increase by about 3.24 percentage points. For reaching proficiency in each additional IXL Math skill per student per week, the math proficiency rate would increase by 4.01 percentage points. Finally, for each additional IXL Math skill mastered per student per week, the math proficiency rate would increase by 8.38 percentage points. Figure 3 shows the expected improvement in the math proficiency rate resulting from increased IXL Math usage.

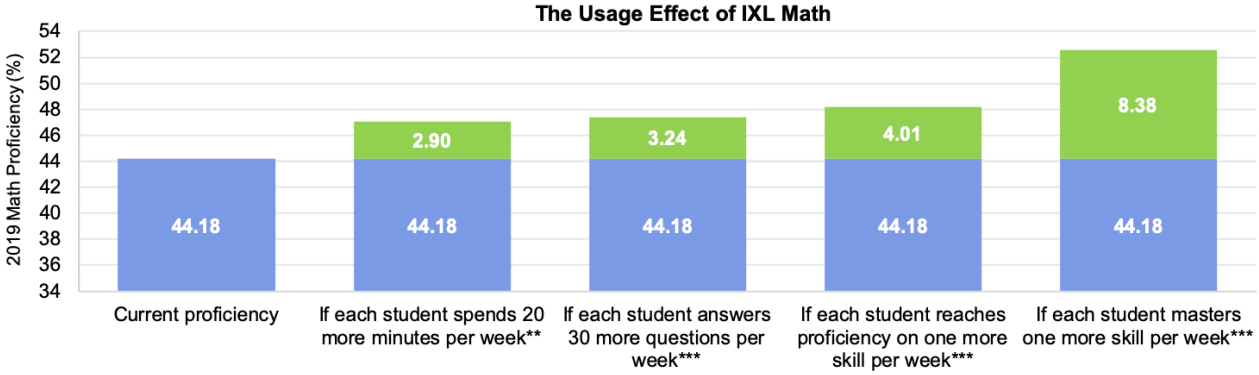


Figure 3. The Expected Usage Effect of IXL Math

The Overall Efficacy of IXL ELA

IXL ELA adoption had a positive and statistically significant effect on school performance on K-PREP Reading (F [10,928] = 225.90, p < .001). Recall that this model included one- or two-year short-term implementation as well as three-year long-term implementation indicators as predictors for 2019 K-PREP ELA performance, controlling for 2016 K-PREP ELA performance and demographic background variables. This model explained 71% of the variability in 2019 K-PREP proficiency rates. See Appendix B, Table B2 for detailed results.

One- or two-year IXL ELA adoption had an unstandardized coefficient of 3.09 (p = .001; Cohen's d = .20), while three-year IXL ELA adoption had an unstandardized coefficient of 6.12 (p = < .001; Cohen's d = .39). That is, if an average non-IXL school at the 50th percentile had used IXL ELA for one or two school years, the school could expect its reading proficiency rate to increase by 3.09 percentage points, putting the school at the 58th percentile. If an average non-IXL school had used IXL ELA for three school years, the school could expect its reading proficiency rate to increase by 6.12 percentage points and rank at the 65th percentile (see Fig. 4).

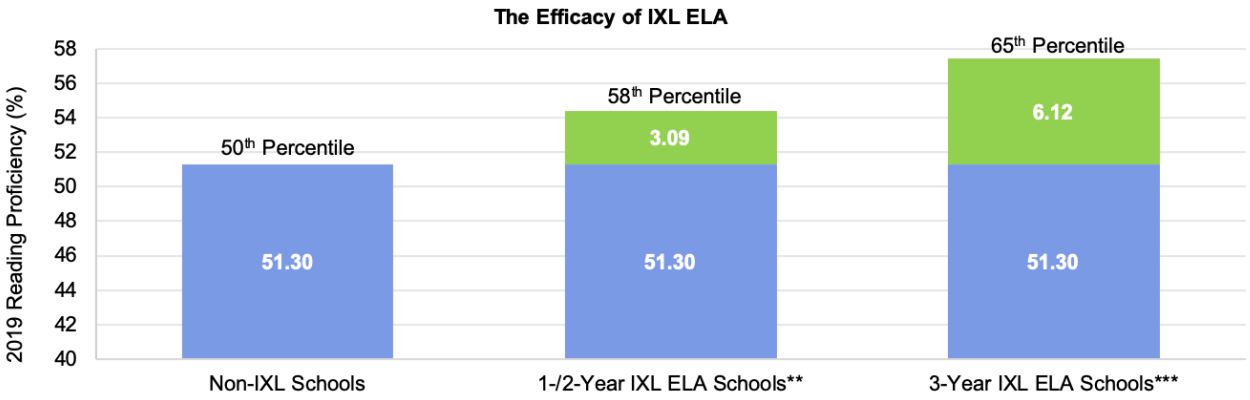


Figure 4. The Overall Efficacy of IXL ELA

The Usage Effect of IXL ELA

Using data from 206 IXL ELA schools, we also examined the IXL ELA usage effect. The four IXL ELA usage indicators (i.e., amount of time spent, number of questions answered, number of skills proficient, and number of skills mastered) were added into the model separately and exclusively, resulting in four models. Results showed positive associations between three IXL ELA usage indicators and schools' reading proficiency rates, with p values < .05, except for number of skills proficient (p = .092). See Appendix C, Table C2 for detailed results.

Specifically, for an average school, for each additional minute spent on IXL per student per week, the reading proficiency rate would increase by .17 percentage points. For example, if each student spent 20 additional minutes per week on IXL, the reading proficiency rate would increase by 3.40 percentage points. For each additional question answered per student per week, the reading proficiency rate would increase by .06 percentage points. For example, if each student answered 30 additional questions per week, the reading proficiency rate would increase by 1.80 percentage points. Finally, for each additional IXL ELA skill mastered per student per week, the reading proficiency rate would increase by 6.50 percentage points. Figure 5 shows the expected improvement in the reading proficiency rate resulting from increased IXL ELA usage.

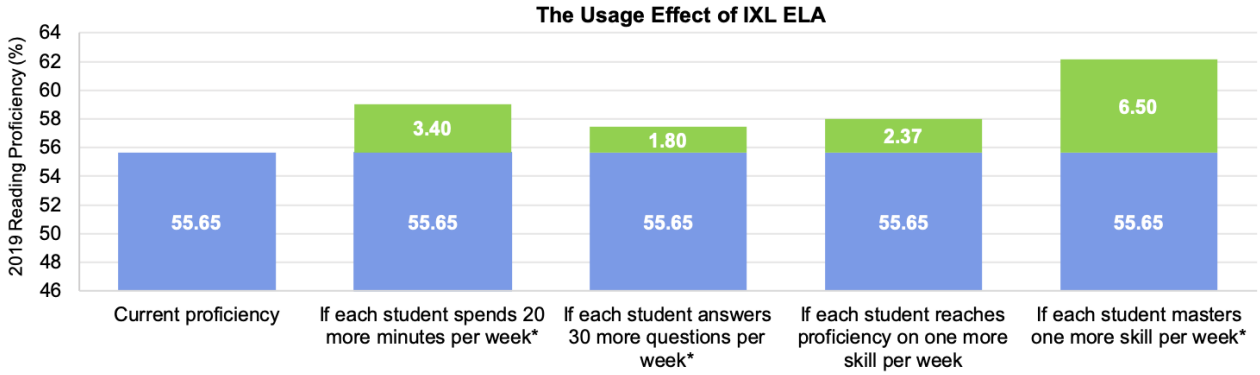


Figure 5. The Expected Usage Effect of IXL ELA

Conclusion

In sum, the study results indicated that IXL usage has a positive and statistically significant impact on school performance in corresponding subjects on the K-PREP assessments. The longer a school used IXL, the better it performed. This study also supported the cumulative effect of IXL usage—the more students worked on IXL, the better they performed. Thus, schools seeking to increase student learning and performance gains should encourage increased IXL usage accordingly.

Implications

Despite these encouraging findings, note that the usage of IXL was relatively low among IXL schools in the present study. This is consistent with previous findings on suboptimal technology usage (e.g., IXL Learning, 2020). IXL's usage recommendation is for students to aim to reach proficiency on two IXL skills per week, in order to maximize IXL's impact on student learning outcomes. However, students in IXL schools in the present study reached proficiency in less than one skill in math and less than half a skill in ELA per week, on average. As the fidelity of implementation affects program success and outcomes tremendously (Dumas, Lynch, Laughlin, Smith, & Prinz, 2001; Noell, Gresham, & Gansle, 2002), we would expect even larger treatment effects with adequate usage. This result also suggests a need for implementation plans and comprehensive training for teachers.

Interestingly, for both math and reading, we noticed an overall performance drop in proficiency among Kentucky schools from 2016 to 2019 (see Appendix A). Our findings suggest that IXL is able to mitigate or even flip this negative trend in achievement. Since the onset of the COVID-19 pandemic, researchers have modeled the projected negative impact of school closures on learning outcomes (e.g., Kuhfeld et al., 2020). These studies consistently predict that students would be making far less progress than they would be in a normal school year. In light of the findings in this study, however, IXL could be one of the solutions to alleviate or even overcome this negative impact.

References

Cohen, J. (1994). The earth is round ($p < .05$). *American Psychologist*, *49*, 997-1003.

Dumas, J. E., Lynch, A. M., Laughlin, J. E., Smith, E. P., & Prinz, R. J. (2001). Promoting intervention fidelity: Conceptual issues, methods, and preliminary results from the EARLY ALLIANCE prevention trial. *American journal of preventive medicine*, *20*(1), 38-47.

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

IXL Learning. (2020). *The Effect of IXL Math and IXL Language Arts in an Indiana School District*. Retrieved from https://www.ixl.com/research/The-Effect-of-IXL-Math-and-ELA-in-an-Indiana-School-District.pdf

Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., & Liu, J. (2020). Projecting the potential impact of COVID-19 school closures on academic achievement. *Educational Researcher*, *49*(8), 549-565.

Noell, G., Gresham, F., & Gansle, K. (2002). Does treatment integrity matter? A preliminary investigation of instructional implementation and mathematics performance. *Journal of Behavioral Education*, *11*, 51–67.

What Works Clearinghouse (2020). *What Works Clearinghouse procedures and standards handbook (Version 4.1)*. Retrieved from: https://ies.ed.gov/ncee/wwc/Docs/referenceresources/WWC-Standards-Handbook-v4-1-508.pdf

Appendix A. Schools' Background Information

Table A. Background Information for All Schools and IXL Schools

	All schools	IXL Math schools	IXL ELA schools
# of schools	1,507	264	206
Pretest and posttest:			
2016 Math proficiency	48.90%	51.43%	-
2019 Math proficiency	43.44%	48.51%	-
2016 Reading proficiency	54.57%	-	57.81%
2019 Reading proficiency	52.32%	-	58.55%
Demographic:			
School location: city	13.30%	12.50%	12.10%
School location: suburb	18.00%	13.30%	9.70%
School location: town	25.30%	25.40%	26.20%
School location: rural	42.40%	48.90%	51.90%
School size	482.05	485.92	451.90
English language learners	3.95%	3.70%	2.71%
Students with disabilities	19.35%	19.05%	20.06%
Economically disadvantaged students	64.62%	64.82%	66.20%

Note. The background information reported in the table is averaged across schools.

Appendix B. IXL Efficacy Results

Table B1. The Effect of IXL Math on 2019 Math Proficiency

	B	95% CI for *B*	*SE*	β	*t*	*p*
(Constant)	41.61	39.80 – 43.43	0.92		45.12	.000
2016 Math proficiency[1]	0.87	0.82 – 0.93	0.03	.75	31.03	.000
School location: suburb[2]	-0.13	-2.48 – 2.23	1.20	.00	-0.11	.917
School location: town[2]	2.09	-0.10 – 4.28	1.12	.05	1.87	.062
School location: rural[2]	1.57	-0.51 – 3.65	1.06	.05	1.48	.139
School size[1]	0.00	0.00 – 0.00	0.00	-.02	-1.08	.282
Students with disabilities[1]	17.81	12.10 – 23.51	2.91	.13	6.12	.000
Economically disadvantaged students[1]	-9.77	-14.52 – -5.03	2.42	-.10	-4.04	.000
One- or two-year IXL Math	**2.64**	**0.58 – 4.70**	**1.05**	**.05**	**2.51**	**.012**
Three-year IXL Math	**5.49**	**2.79 – 8.19**	**1.38**	**.08**	**3.99**	**.000**

Note. [1] mean-centered; [2] dummy coded; location of city as the reference group. *B* = unstandardized regression coefficient. CI = confidence interval. *SE* = standard error. β = standardized regression coefficient.

Table B2. The Effect of IXL ELA on 2019 Reading Proficiency

	B	95% CI for *B*	*SE*	β	*t*	*p*
(Constant)	51.30	49.66 – 52.93	0.83		61.48	.000
2016 Reading proficiency[1]	0.88	0.83 – 0.94	0.03	.79	32.87	.000
School location: suburb[2]	1.27	-0.76 – 3.30	1.04	.03	1.23	.221
School location: town[2]	0.56	-1.44 – 2.55	1.02	.02	0.55	.583
School location: rural[2]	0.28	-1.65 – 2.20	0.98	.01	0.28	.779
School size[1]	0.00	-0.01 – 0.00	0.00	-.07	-3.25	.001
English language learners[1]	-7.01	-14.82 – 0.80	3.98	-.04	-1.76	.078
Students with disabilities[1]	10.63	5.77 – 15.48	2.47	.09	4.30	.000
Economically disadvantaged students[1]	-6.24	-10.45 – -2.03	2.14	-.07	-2.91	.004
One- or two-year IXL ELA	**3.09**	**1.23 – 4.95**	**0.95**	**.06**	**3.26**	**.001**
Three-year IXL ELA	**6.12**	**3.21 – 9.03**	**1.48**	**.07**	**4.13**	**.000**

Note. [1] mean-centered; [2] dummy coded; location of city as the reference group. *B* = unstandardized regression coefficient. CI = confidence interval. *SE* = standard error. β = standardized regression coefficient.

Appendix C. IXL Usage Effect Results

Table C1. IXL Math Usage Effects on 2019 Math Proficiency

	B	95% CI for *B*	*SE*	β	*t*	*p*
Baseline Model						
(Constant)	47.51	44.06 – 50.96	1.75		27.09	.000
2016 Math proficiency[1]	0.78	0.68 – 0.88	0.05	.69	15.60	.000
School location: suburb[2]	-3.39	-7.90 – 1.12	2.29	-.08	-1.48	.140
School location: town[2]	-0.09	-4.01 – 3.84	1.99	.00	-0.04	.966
School location: rural[2]	-1.32	-5.12 – 2.48	1.93	-.04	-0.68	.495
School size[1]	-0.01	-0.01 – 0.00	0.00	-.15	-3.33	.001
Students with disabilities[1]	3.74	-8.94 – 16.42	6.44	.03	0.58	.562
Economically disadvantaged students[1]	-11.00	-19.68 – -2.33	4.41	-.12	-2.50	.013
Three-year IXL Math[3]	3.22	0.79 – 5.65	1.23	.10	2.61	.009
IXL Math Usage Models						
Time spent (in minutes)	**0.15**	**0.04 – 0.25**	**0.05**	**.11**	**2.76**	**.006**
Questions answered	**0.11**	**0.06 – 0.16**	**0.03**	**.17**	**4.37**	**.000**
Skills proficient	**4.01**	**1.87 – 6.14**	**1.08**	**.14**	**3.70**	**.000**
Skills mastered	**8.38**	**5.02 – 11.74**	**1.71**	**.18**	**4.91**	**.000**

Note. [1] mean-centered; [2] dummy coded; location of city as the reference group; [3] dummy coded; one- or two-year IXL Math schools as the reference group. *B* = unstandardized regression coefficient. CI = confidence interval. *SE* = standard error. β = standardized regression coefficient.

Table C2. IXL ELA Usage Effects on 2019 Reading Proficiency

	B	95% CI for *B*	*SE*	β	*t*	*p*
Baseline Model						
(Constant)	55.65	52.07 – 59.23	1.82		30.60	.000
2016 Reading proficiency[1]	0.73	0.62 – 0.85	0.06	.64	12.63	.000
School location: suburb[2]	-3.17	-7.88 – 1.55	2.39	-.08	-1.32	.187
School location: town[2]	0.92	-3.10 – 4.94	2.04	.03	0.45	.651
School location: rural[2]	1.21	-2.78 – 5.19	2.03	.05	0.60	.552
School size[1]	-0.01	-0.01 – 0.00	0.00	-.12	-2.33	.021
English language learners[1]	-14.46	-31.05 – 2.13	8.42	-.08	-1.72	.087
Students with disabilities[1]	-5.47	-17.26 – 6.33	5.99	-.05	-0.91	.362
Economically disadvantaged students[1]	-7.59	-15.96 – 0.79	4.25	-.10	-1.78	.076
Three-year IXL Math[3]	2.21	-0.27 – 4.68	1.26	.07	1.76	.080
IXL ELA Usage Models						
Time spent (in minutes)	**0.17**	**0.02 – 0.32**	**0.08**	**.09**	**2.18**	**.030**
Questions answered	**0.06**	**0.01 – 0.12**	**0.03**	**.09**	**2.23**	**.027**
Skills proficient	**2.37**	**-0.39 – 5.14**	**1.40**	**.07**	**1.69**	**.092**
Skills mastered	**6.50**	**1.39 – 11.62**	**2.60**	**.11**	**2.51**	**.013**

Note. [1] mean-centered; [2] dummy coded; location of city as the reference group; [3] dummy coded; one- or two-year IXL ELA schools as the reference group. *B* = unstandardized regression coefficient. CI = confidence interval. *SE* = standard error. β = standardized regression coefficient.