RESEARCH REPORT

April 2022

The Impact of IXL on High School Math Learning in Texas

Christina Schonberg, Ph.D.

IXL LEARNING 777 Mariners Island Blvd., Suite 600, San Mateo, CA 94404
650-372-4040 | www.ixl.com

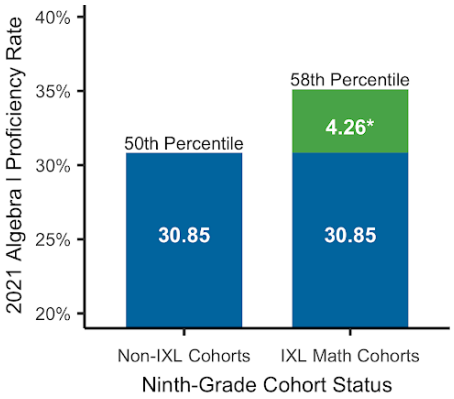
Executive Summary

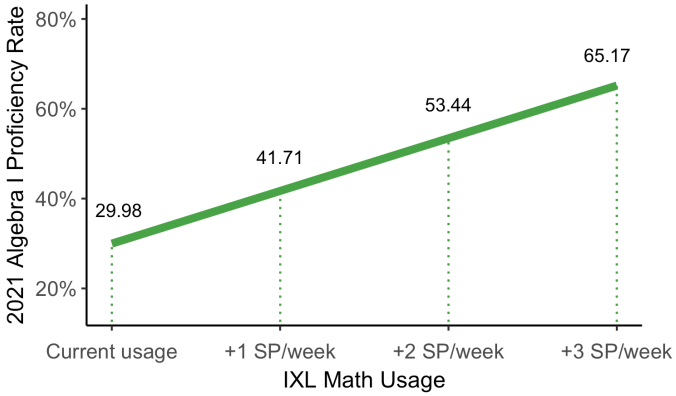
IXL is a personalized learning platform designed to help students build academic skills in subjects including math and English language arts (ELA). Previous research has shown that IXL can have a significant positive impact on students' academic performance (Bashkov, 2021; Empirical Education, 2013).

The goal of this study was to examine IXL usage among high school students in Texas and its relation to academic performance in math, specifically the State of Texas Assessment of Academic Readiness (STAAR) in Algebra I (taken primarily by ninth-graders). Using 2019 STAAR Algebra I performance as pretest and 2021 STAAR Algebra I performance as posttest, we found that[1]:

- **IXL implementation improves student achievement.** Ninth-grade cohorts that used IXL Math performed better on STAAR Algebra I than comparable cohorts that did not use IXL. Specifically, the proficiency rate[2] was about four percentage points higher for IXL Math cohorts, relative to cohorts not using IXL.

- **Higher levels of IXL usage are related to larger achievement gains.** Higher IXL Math usage was associated with better STAAR Algebra I performance.[3]





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

[2]Proficiency rate: percentage of students in a cohort classified as "Meets" or "Masters" grade level performance on the STAAR.

[3]In all figures: SP/week = skills proficient per week

The Impact of IXL on High School Math Learning in Texas

Background

IXL is a powerful, flexible educational technology platform that provides personalized learning in four main subject areas—mathematics, English language arts (ELA), science, and social studies—for students in grades pre-K through 12. Currently, IXL is used by 23% of students in the U.S. and by over 13 million students worldwide. Deeply rooted in learning sciences research (see Bashkov et al., 2021), IXL engages each student in a personalized learning experience tailored to their working level. As a result, students work through problems that are neither too easy nor too difficult, which in turn supports their self-efficacy and motivation for continued learning.

The goal of this study was to examine the efficacy of IXL Math at the high school level in Texas, as well as the effects of increased IXL usage on high school math achievement. We investigated the efficacy of IXL by comparing State of Texas Assessment of Academic Readiness (STAAR) Algebra I proficiency rates among ninth-grade cohorts that had used IXL to those of ninth-grade cohorts that had not used IXL. We then investigated the usage effects of IXL by examining the continuous relationship between amount of IXL usage and STAAR Algebra I performance.

Methodology

DATA SOURCES

Assessment and Demographic Data

All assessment and demographic data were obtained from the Texas Education Agency. Math performance at pretest (2019) and posttest (2021) was measured using STAAR, a standardized assessment administered to Texas students at the end of high school courses including English I, English II, Biology, U.S. History, and Algebra I (as well as annually in ELA and mathematics for students in Grades 3-8; this report focuses on the high school level). The outcome measure was the percentage of ninth-graders within a high school reaching proficiency in Algebra I (i.e., the proficiency rate on the Algebra I exam). More information about STAAR can be found at https://tea.texas.gov/student-assessment/testing.

IXL Usage Data

IXL usage data were obtained from IXL's internal database. When students use IXL, they complete practice problems organized within "skills," or specific topic areas within a subject. IXL uses a proprietary *SmartScore* to indicate a student's proficiency within a skill. The SmartScore ranges from 0-100 and increases as students answer questions correctly. However, it is not a percent correct score; a SmartScore of 100 is always possible. A SmartScore of 80 indicates proficiency in a skill, and a SmartScore of 100 indicates mastery. IXL's current usage recommendation is that students should aim to reach proficiency in two skills per week.

OVERALL EFFICACY

Study Design

In this study, we used a quasi-experimental pretest-posttest control group design to compare the proficiency rates of ninth-grade cohorts in high schools that had used IXL during the 2019-20 and 2020-21 school years to the proficiency rates of ninth-grade cohorts in high schools that did not use IXL at all during this time (Figure 1).

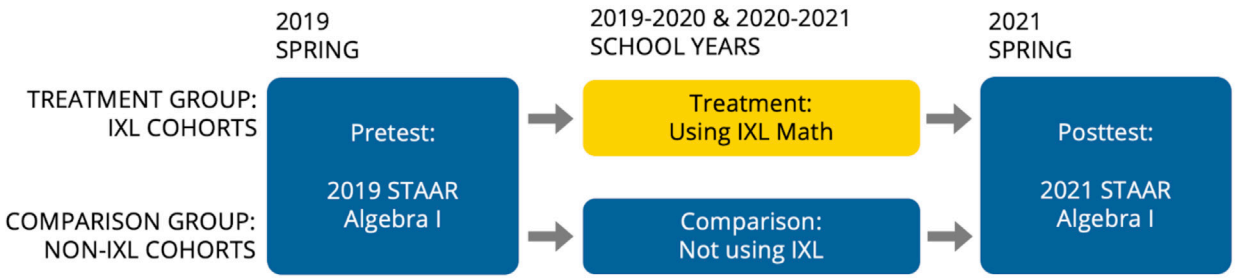


Figure 1. Study Design

Participants

Because Algebra I (and its corresponding STAAR test) is most commonly taken by students in ninth grade, we identified high schools with ninth-grade cohorts that used IXL during the study period (i.e., the 2019-20 and 2020-21 school years). We defined IXL cohorts as those coming from high schools in which at least 15% of ninth-graders, on average, used IXL during the study period. This threshold allowed us to accommodate a wide variety of usage levels, maximizing the generalizability of the study; at the same time, it ensured that we would not include grade cohorts with extremely low uptake. We defined comparison cohorts as those in which ninth-graders did not use IXL at all during the study period. Using this criterion, we obtained a sample of 50 treatment cohorts and 798 comparison cohorts. Descriptive statistics for treatment cohorts' IXL usage during the study period can be found in Table 1.

Table 1. **Usage of IXL Math among students in ninth-grade treatment cohorts**

IXL usage (per week)	IXL Math (*n* = 50)			
	M	*SD*	Min	Max
Time spent (in minutes)	9.90	7.46	0.50	33.18
Questions answered	13.28	9.51	0.69	44.64
Skills proficient	0.30	0.25	0.02	1.20

Analysis

We specified and tested a multilevel model to account for clustering at the district level (i.e., grade cohorts within a district tend to be more similar to each other than grade cohorts in other districts). In these models, we regressed the 2021 ninth-grade proficiency rate on IXL cohort status (treatment or comparison) and covariates (baseline performance and demographic characteristics). Specifically, we controlled for the following school-level demographic characteristics: percentage of male students; percentage of White students; percentage of students receiving special education; percentage of economically disadvantaged students; percentage of English learners; and school Title I status. In addition, we controlled for grade size.

Following What Works Clearinghouse guidelines (WWC, 2020), each effect is accompanied by a test of statistical significance using a probability (*p*) value, a measure of effect size, and corresponding percentile gain where applicable. The *p*-value is the probability of observing the current or more extreme data, assuming the effect is zero (Cohen, 1994). The smaller the *p*-value, the less likely it is that the result occurred at random; *p*-values less than .05 are considered statistically significant. Effect size is reported using Hedges' *g* and indicates the difference between treatment and control groups on an outcome measure in standard deviation units. For broad-scope educational assessments, moderate effect sizes range from about 0.10–0.20, and effect sizes of about 0.20 or higher are considered large (Kraft, 2020; Lipsey et al., 2012). Percentile gain is the expected change in IXL cohorts' percentile rank relative to non-IXL cohorts at the 50th percentile and is based on the effect size. Given that this analysis is at the grade cohort level (i.e., ninth-grade students), this effect size should be interpreted at the grade cohort level as well.

USAGE EFFECTS

The goal of the second analysis was to investigate the relationship between increased IXL usage and STAAR Algebra I performance. We specifically examined cohorts' average weekly skill proficiency (SP/week) as the IXL usage metric of interest, as reaching proficiency in a skill indicates that a student has put forth a considerable amount of effort in practicing and learning the material.

Participants

In this analysis, we included all ninth-grade cohorts with any amount of IXL usage during the study period. After we removed two outlier cohorts who had IXL usage further than ±3 *SD* from the mean, the final sample consisted of 126 ninth-grade cohorts.

Analysis

As in the previous analysis, we specified and tested a multilevel model to account for the fact that cohorts were clustered within districts. The outcome variable—2021 STAAR Algebra I proficiency rate—and covariates were the same as those of the previous analysis. Here, we examined the effect of IXL usage by including a continuous predictor variable in the model: each cohort's average SP/week. As there was no control or comparison group, Hedges' *g* is not applicable; however, we report a standardized regression coefficient to gauge the practical significance of IXL usage relative to the effects of the covariates. As with the previous analysis, effects should be interpreted at the grade cohort level.

Results

OVERALL EFFICACY

We found that ninth-grade cohorts that used IXL Math outperformed comparable non-IXL cohorts on the 2021 STAAR Algebra I test. Specifically, the proficiency rate was about four percentage points higher for IXL Math cohorts relative to cohorts not using IXL (Figure 2). The estimated treatment effect for IXL Math was positive and statistically significant (b = 4.26, p = .020; see Table B1 in Appendix B for full model results). The effect size (Hedges' g) was 0.21, which corresponds to a percentile gain of eight points.

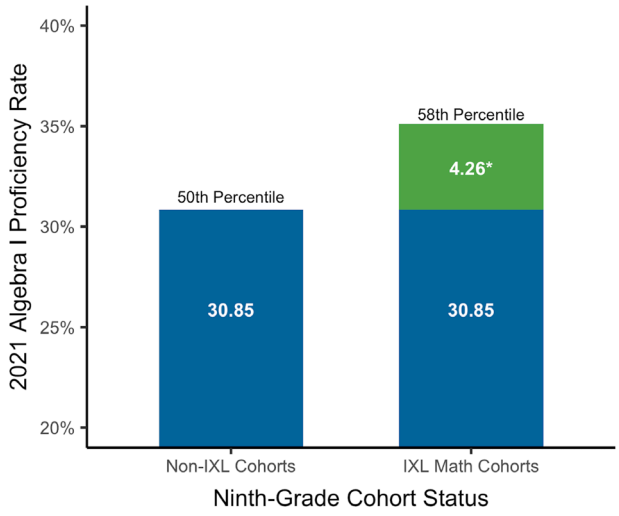


Figure 2. The efficacy of IXL Math

USAGE EFFECTS

We found that increased IXL Math usage was positively and statistically significantly associated with 2021 STAAR Algebra I proficiency rate (b = 11.73, β = 0.16, p = .032; see Figure 3). That is, reaching proficiency in one additional IXL Math skill per week would be expected to increase a typical cohort's proficiency rate by 11.73 percentage points. Full model results are presented in Appendix B, Table B2.

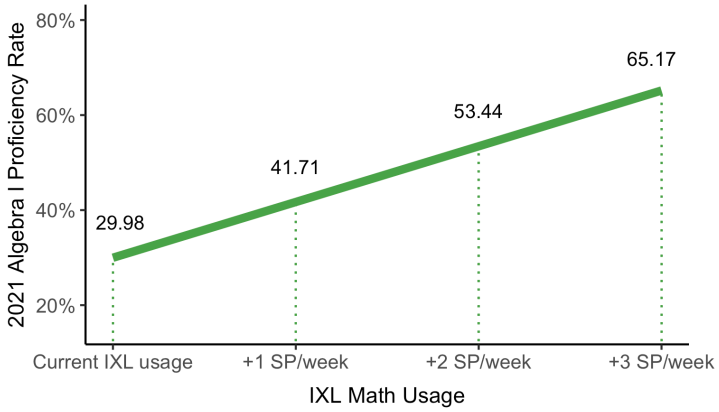


Figure 3. Predicted usage effects of IXL Math

Note: SP/week = skills proficient per week

Discussion

In this study, we investigated the efficacy of IXL Math across ninth-grade cohorts in Texas public high schools. We found that cohorts that used IXL performed significantly better on STAAR Algebra I than cohorts that did not use IXL, controlling for baseline performance and demographics. In addition, increased IXL usage was associated with higher STAAR Algebra I proficiency rates. These results add to the large body of evidence that IXL is a highly effective way to bolster student learning (e.g., An, 2021a, 2021b; IXL Learning, 2019, 2020).

In this sample, students' usage of IXL was somewhat lower than IXL's recommendation of reaching proficiency in two skills per week. Nevertheless, we found strong effects of IXL usage, showing that IXL is a powerful educational tool even in small doses. Because interventions are more effective when they are carried out with fidelity (see Finney et al., 2021; Noell et al., 2002), we anticipate that students would experience even greater gains when IXL is used as recommended.

The COVID-19 pandemic has caused widespread disruptions in education, resulting in greater-than-normal knowledge gaps or learning loss for many students. Indeed, we found that the overall Algebra I proficiency rates in this sample decreased between 2019 and 2021. However, IXL usage attenuated the adverse academic impact of the pandemic: IXL cohorts showed a smaller decline (about 17 percentage points) compared to non-IXL cohorts (about 21 percentage points; see Table A1). IXL has helped students continue to learn because it provides a unique approach to personalized learning. With its adaptive software that analyzes students' response patterns during practice, IXL recognizes content areas where students may be struggling and engages them with material at the appropriate level.

By meeting students where they are, IXL can help students "catch up" by providing support for relearning missed or forgotten material. This combination of personalized learning and remediation has been suggested as a highly effective approach for both recovering from pandemic-related learning loss as well as boosting future learning gains (Kaffenberger, 2021). The transition to high school can be academically challenging for many ninth-graders, but continued use of IXL can set these students up for success both during this transition and beyond.

References

An, X. (2021a). *Associations between IXL Usage and IXL Impact in Math and ELA: Analysis of Data from Seven States* (pp. 1–17). IXL Learning. https://www.ixl.com/research/Impact_of_IXL_in_7_states.pdf

An, X. (2021b). *Measuring the impact of IXL Math and IXL Language Arts in Kentucky schools* (pp. 1–16). https://www.ixl.com/research/Impact-of-IXL-in-Kentucky.pdf

Bashkov, B. M. (2021). *Assessing the Impact of IXL Math over Three Years: A Quasi-Experimental Study* (pp. 1–12). https://www.ixl.com/materials/us/research/IXL_Math_3-Year_QED_ESSA_Tier_2.pdf

Bashkov, B. M., Mattison, K., & Hochstein, L. (2021). *IXL design principles: Core features grounded in learning science research* (pp. 1–18). https://www.ixl.com/research/IXL_Design_Principles.pdf

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

Empirical Education. (2013). *A study of student achievement, teacher perceptions, and IXL Math* (pp. 1–12). https://www.empiricaleducation.com/pdfs/IXLfr.pdf

Finney, S. J., Wells, J. B., & Henning, G. W. (2021). *The Need for Program Theory and Implementation Fidelity in Assessment Practice and Standards* (Occasional Paper No. 52; pp. 1–19). University of Illinois and Indiana University, National Institute for Learning Outcomes Assessment (NILOA).

IXL Learning. (2019). *The impact of IXL Math and IXL ELA on student achievement in grades pre-K to 12* (pp. 1–27). https://www.ixl.com/research/ESSA-Research-Report.pdf

IXL Learning. (2020). *Measuring the impact of IXL Math and IXL Language Arts in Pennsylvania schools* (pp. 1–15). https://www.ixl.com/research/Impact-of-IXL-in-Pennsylvania.pdf

Kaffenberger, M. (2021). Modelling the long-run learning impact of the Covid-19 learning shock: Actions to (more than) mitigate loss. *International Journal of Educational Development, 81*, 102326. https://doi.org/10.1016/j.ijedudev.2020.102326

Kraft, M. A. (2020). Interpreting effect sizes of education interventions. *Educational Researcher, 49*(4), 241-253. https://doi.org/10.3102/0013189X20912798

Lipsey, M.W., Puzio, K., Yun, C., Hebert, M.A., Steinka-Fry, K., Cole, M.W., Roberts, M., Anthony, K.S., Busick, M.D. (2012). *Translating the statistical representation of the effects of education interventions into more readily interpretable forms.* (NCSER 2013-3000). Washington, DC: National Center for Special Education Research, Institute of Education Sciences, U.S. Department of Education.

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™ Procedures Handbook, Version 4.1. (2020). What Works Clearinghouse, Institute of Education Sciences. https://ies.ed.gov/ncee/wwc/handbooks

Appendix A: Demographics

Table A1. Demographic characteristics of treatment (IXL) and comparison (non-IXL) groups

	IXL Cohorts	Non-IXL Cohorts
Pretest and posttest	*n* = 50	*n* = 798
2019 % proficient	49.72 (22.74)	50.11 (20.90)
2021 % proficient	32.94 (21.98)	29.22 (20.21)
School demographics		
Title 1 schools (*n* schools)	47	745
Grade size (*n* students)	349.36 (286.89)	311.33 (275.06)
Gender: % male	51.04 (3.96)	51.37 (4.97)
Race: % White	25.88 (23.70)	27.98 (24.14)
% Special education	11.19 (3.16)	10.71 (3.81)
% Economically disadvantaged	67.39 (17.68)	63.30 (19.96)
% English learners	15.94 (12.76)	14.63 (12.82)

Note. Baseline performance and demographic characteristics are presented as *M (SD).*

Appendix B: Full Results of Usage Analyses

Table B1. Full IXL Math efficacy model

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	30.85	2.21	26.53 – 35.16	0.07	13.945	<.001
Gender: % male[1]	-0.02	0.08	-0.19 – 0.14	-0.01	-0.290	.772
Race: % White[1]	0.34	0.03	0.27 – 0.40	0.40	9.753	<.001
% Special education[1]	-0.24	0.15	-0.54 – 0.06	-0.04	-1.586	.113
% English learners[1]	0.06	0.05	-0.04 – 0.15	0.04	1.154	.249
% Economically disadvantaged[1]	-0.04	0.04	-0.12 – 0.04	-0.04	-0.954	.340
Title I school[2]	-0.48	2.23	-4.83 – 3.88	-0.02	-0.213	.831
Grade size (N students)[1]	-0.01	0.00	-0.01 – 0.00	-0.10	-3.600	<.001
2019 STAAR Algebra I % proficient[1]	0.40	0.03	0.35 – 0.45	0.42	15.929	<.001
Used IXL Math	**4.26**	**1.83**	**0.69 – 7.83**	**0.21**	**2.329**	**.020**

Note. Dependent variable: Percent of ninth-graders reaching proficiency on 2021 STAAR Algebra I. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient. [1] Grand-mean centered. [2] Dummy coded; non-Title I schools as reference group.

Table B2. Full IXL Math usage model

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	29.98	6.14	18.33 – 41.62	0.19	4.881	<.001
Gender: % male[1]	-0.32	0.46	-1.20 – 0.56	-0.05	-0.694	.489
Race: % White[1]	0.30	0.09	0.13 – 0.46	0.38	3.358	.001
% Special education[1]	0.93	0.52	-0.05 – 1.92	0.14	1.805	.074
% English learners[1]	0.23	0.13	-0.03 – 0.48	0.15	1.724	.089
% Economically disadvantaged[1]	0.03	0.12	-0.19 – 0.26	0.03	0.291	.772
Title I school[2]	-3.56	6.18	-15.28 – 8.16	-0.19	-0.576	.566
Grade size (N students)[1]	-0.01	0.01	-0.02 – 0.00	-0.11	-1.261	.210
2019 STAAR Algebra I % proficient[1]	0.46	0.08	0.32 – 0.61	0.48	6.120	<.001
IXL Math Skills Proficient[3]	**11.73**	**5.39**	**1.52 – 21.98**	**0.16**	**2.177**	**.032**

Note. Dependent variable: Percent of ninth-graders reaching proficiency on 2021 STAAR Algebra I. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient. [1] Grand-mean centered. [2] Dummy coded; non-Title I schools as reference group. [3] Weekly average amount per student.