RESEARCH REPORT

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The Impact of IXL Math on Middle and High School Math Learning in a Virginia School District

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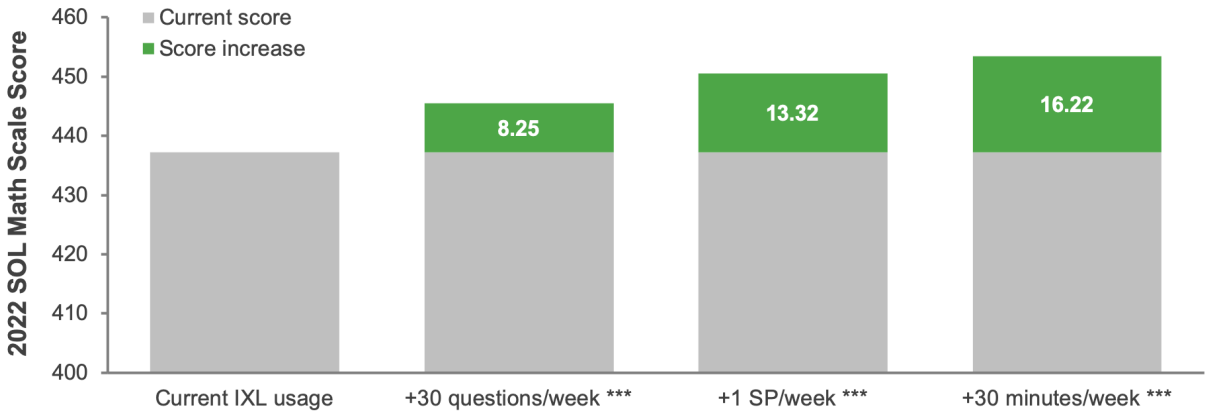
Executive Summary

IXL is an end-to-end teaching and learning solution that engages learners in grades Pre-K through 12 with a comprehensive curriculum in core subjects and personalized recommendations for meeting learning goals. IXL has been shown to have a significant positive impact on students' academic performance (e.g., An, 2021; Bashkov, 2021; Empirical Education, 2013; IXL Learning, 2018 Schonberg, 2021).

To further evaluate the impact of IXL Math, especially for middle and high school students in Virginia, we studied more than 5,000 students in grades 6 through 11 from 23 public schools in a large suburban school district in Virginia. Using multilevel linear regression models to account for students' school membership, baseline performance in 2021, and demographic background, we found statistically significant and positive effects of IXL Math on students' performance on the 2022 Standards of Learning (SOL) assessments in math. Key findings include[1]:

- **More IXL practice is associated with better performance.** Students performed significantly better on the 2022 SOL math tests when they answered more questions on IXL Math, reached proficiency in more skills, and spent more time practicing. Moreover, students who used IXL Math with high fidelity (i.e., reached proficiency in at least two IXL Math skills per week) performed significantly better than their peers.



- **Both middle schoolers and high schoolers benefit from using IXL.** We found similar usage effects among students in grades 6 to 8 and students in grades 9 to 11; the higher students' IXL Math usage, the better their performance.

- **IXL also benefits student subgroups from diverse backgrounds.** We found even larger usage effects among Black students, Hispanic students, English language learners, and students enrolled in special education services.

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

The Impact of IXL Math on Middle and High School Math Learning in a Virginia School District

Background

IXL is an end-to-end teaching and learning solution that engages learners in grades Pre-K through 12 with a comprehensive curriculum and personalized recommendations for meeting learning goals. It covers four main subject areas: mathematics, English language arts (ELA), science, and social studies. As of this writing, 38% of students in Virginia and about 14 million students worldwide use IXL. 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. Numerous studies have consistently demonstrated the positive effects of IXL on student learning outcomes at various grade levels in different subjects across many states (see https://www.ixl.com/research). To maximize student learning gains, IXL recommends that students aim to reach proficiency in at least two IXL skills per week (2 SP/week; An et al., 2022). Thus, the purpose of this study was to examine IXL Math's efficacy specifically among middle and high school students overall and against the 2 SP/week usage target, as well as among several student subgroups using data from one Virginia school district.

Study Design and Methodology

Research Questions

The present study aimed to examine three research questions:

Research Question 1. What were the usage effects of IXL Math on students' 2022 SOL math performance, controlling for 2021 baseline performance and demographic background? Did students who used IXL with high fidelity (>= 2 SP/week) make greater academic gains?

Research Question 2. Did IXL Math benefit both middle schoolers and high schoolers? That is, were there similar usage effects of IXL Math on 2022 SOL math performance among students in middle school grades and students in high school grades?

Research Question 3. What were the usage effects of IXL Math on 2022 SOL math performance among student subgroups from diverse backgrounds, including Black students, Hispanic students, English language learners, and students enrolled in special education services?

Data Sources

This study analyzed data from a total of 5,442 students in grades 6 through 11 who used IXL during the 2021-22 school year. The students were attending 23 public schools in a large suburban school district in Virginia. Data from three sources were used in this study: students' state assessment data, their demographic data, and their IXL practice data.

Student Assessment Data

The district provided the 2020-21 and 2021-22 state assessment data in math for students. Every spring, the Standards of Learning (SOL) assessments are administered to students in grades 3 to 12 (see Virginia Department of Education for more details). Spring 2021 SOL math assessments (including Algebra 1) were used as the pretest to control for students' baseline performance in math before using IXL. Students' scale scores on the Spring 2022 SOL math tests (including Algebra 1) served as the posttest in order to examine the impact of IXL.

Student Demographic Data

Demographic background information provided by the district included student grade, gender, race/ethnicity, English language learner (ELL) status, and disability status (i.e., enrollment in special education services). Students with missing assessment or demographic data were excluded from the analysis, resulting in a sample of 5,442 students.

Student IXL Usage Data

Students' IXL Math usage data from the 2021-22 school year were retrieved from IXL's database. IXL usage indicators included the number of questions answered on IXL Math, the number of skills in which students reached proficiency (i.e., skills proficient), and the amount of time spent (in minutes). See Table 1 for detailed information on weekly average IXL usage across the 2021-22 school year (about 36 weeks). There was a wide range of usage among students. For example, the number of skills proficient on IXL Math ranged from 0 to about 17 skills per week, and time spent on IXL Math ranged from 0 minutes to more than 3 hours per week.

Table 1. **Weekly IXL Math Usage**

	M	*SD*	Min	Max
Questions answered	22.92	30.94	0.00	625.75
Skills proficient	0.64	0.84	0.00	17.24
Time spent (in minutes)	11.76	12.55	0.00	202.89

Note. n = 5,442

Using three standard deviations from the mean level of usage, we identified 153 "super users" of IXL Math. We treated these super users as outliers and removed them from the following analysis in order to obtain a more accurate and generalizable estimate of the IXL effect. Thus, the following analysis is based on the remaining 5,289 students. See Table A1 in Appendix A for more details on academic performance and demographics of the analyzed samples. In terms of using IXL with high fidelity, 116 (2.2%) out of the 5,289 students reached at least 2 SP/week on IXL Math.

Analytic Approach

Multilevel linear regression models were used to examine the usage effect of IXL Math. These models specify students (Level 1) as clustered within schools (Level 2) and account for any shared variability among students attending the same school. At Level 1 (i.e., the student level), the outcome variable was students' scale scores on the 2022 SOL math assessment, controlling for the students' prior math performance in 2021 (i.e., scale scores on the 2021 SOL math assessment) and student demographic background, including student grade, gender, race/ethnicity, ELL status, and special education status. At Level 2 (i.e., the school level), we accounted for clustering. All predictors were either dummy coded or grand mean-centered. This model served as a baseline model.

Research Question 1. To examine the usage effects of IXL, three IXL continuous usage indicators (number of questions answered on IXL, number of skills proficient, and amount of time spent) were added at Level 1 of the baseline model one at a time. Testing the predictive utility of each usage indicator exclusively helped avoid multicollinearity issues due to the strong correlations among these indicators (e.g., students who spent more time on IXL also answered more questions). To examine the added value of reaching 2 SP/week (i.e., high-fidelity implementation) over typical implementation, we used similar multilevel linear regression models as the ones described above. The only difference here was the main predictor of interest: using IXL with high fidelity or not, at Level 1 of the baseline model, as opposed to a continuous predictor of IXL usage.

Research Question 2. To evaluate the effects of IXL Math among middle schoolers and high schoolers, we analyzed the data separately for students in grades 6 to 8 and for students in grades 9 to 11. We used similar multilevel linear regression models as described above with the number of skills proficient as the main predictor of interest.

Research Question 3. To evaluate the effects of IXL Math among student subgroups, we used similar multilevel linear regression models as described above with the number of skills proficient as the main predictor of interest. Each model tested data from one student subgroup at a time (e.g., English language learners), without the corresponding covariate (e.g., English language learner status) in the model.

Following What Works Clearinghouse guidelines (WWC, 2020), each effect is accompanied by a statistical significance test with a probability (p) value. The p-value is the probability of observing the current or more extreme data, assuming the tested effect is zero (Cohen, 1994). As such, the smaller the p-value, the less likely it is that the observed result occurred at random, with p-values less than .05 considered statistically significant. In terms of the effect size, we report a standardized regression coefficient to gauge the practical significance of IXL usage in terms of relative predictive utility among the covariates.

Results

Usage Effect of IXL Math Overall

Results showed positive and statistically significant associations between IXL usage indicators and 2022 SOL math performance. This was reflected in both the observed correlations between IXL usage and SOL performance (Table A2 in Appendix A) as well as multilevel linear regression models. Specifically, the number of questions answered, the number of skills proficient, and the amount of time spent on IXL Math were all significant predictors of 2022 SOL math scale scores (all p values < .001). See Table B in Appendix B for the full regression results. In sum, the more a student practiced on IXL Math, the better he or she performed on the 2022 SOL math assessment. Figure 1 shows the expected improvement in SOL math scale scores with additional IXL Math usage during the school year.

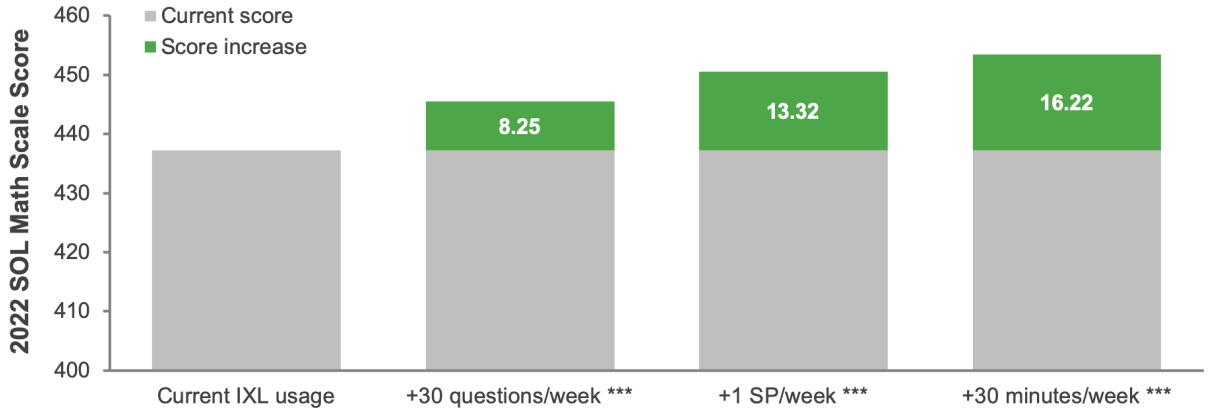


Figure 1. The Usage Effect of IXL Math

Specifically, with each additional question answered on IXL Math per week, an average student's SOL math scale score is expected to increase by about 0.28 points. For example, if a student answered 30 more questions per week, their math score would increase by 8.25 points. We also found that reaching proficiency in each additional IXL Math skill a week was associated with an expected increase of 13.32 points. Finally, with each additional minute spent on IXL Math per week, the SOL math scale score is expected to increase by about 0.54 points. This is, if a student practiced for 30 more minutes per week, their math score would increase by 16.22 points. Students who reached proficiency in at least two skills per week in IXL Math (n = 116) outperformed their peers with less IXL usage (n = 5,173) by scoring 14.93 points higher (p < .001) on the SOL math test.

Usage Effects of IXL Math Among Middle Schoolers and High Schoolers

We evaluated the usage effect of IXL Math for middle schoolers (i.e., grades 6 to 8) and high schoolers (i.e., grades 9 to 11) separately using skills proficient as the main predictor of interest.

[2] Current score is the average SOL math scale score after adjusting for prior performance and demographic characteristics in the model. It is the intercept in the baseline model presented in Table B, Appendix B.

In sum, we found similar usage effects among students in these two grade ranges to the effects we found for all students—the more students practiced on IXL, the better they performed on the 2022 SOL, again controlling for baseline performance and other demographics. Specifically, with each additional skill proficient per week, students in grades 6 to 8 are expected to score 13.15 points higher in math ($p < .001$), while students in grades 9 to 11 are expected to score 14.83 points higher in math ($p < .001$). See Tables C1 and C2 in Appendix C for more details.

Usage Effects of IXL Math Among Student Subgroups from Diverse Backgrounds

We also evaluated the usage effects of IXL Math among student subgroups, including students grouped by race/ethnicity, ELL status, and special education status. We found even larger usage effects among these student subgroups than that we found for all students overall. Specifically, with each additional skill proficient per week, Black students are expected to score 16.51 points higher in math ($p < .001$), Hispanic students are expected to score 21.10 points higher in math ($p < .001$), ELL students are expected to score 19.46 points higher in math ($p < .001$), and special education students are expected to score 17.99 points higher in math ($p < .001$). See tables in Appendix D for more details. Figure 2 shows the expected improvement in SOL math scale scores \with additional IXL Math usage for each student subgroup.

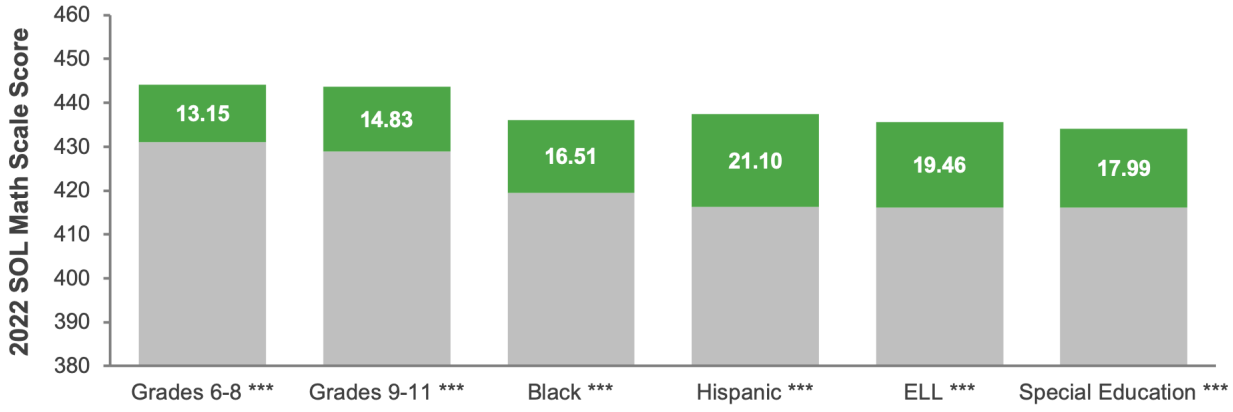


Figure 2. The Usage Effect of IXL Math Among Student Subgroups[3]

Conclusion

This study found a positive and statistically significant association between IXL Math practice and math performance for both middle schoolers and high schoolers. The number of questions answered, the number of skills in which students reached proficiency, and the amount of time spent on IXL were all statistically significant predictors of student math performance on the 2022 SOL math assessment. We expect our findings to generalize to other similar middle and high schools in Virginia and in other states—the more students practice on IXL, the better they will perform on state assessments.

[3] Gray bars represent each group's current score. Green bars represent predicted score increases for each group if students reached proficiency in one additional IXL Math skill per week.

This study also found supportive evidence for IXL's usage recommendation that students aim to reach proficiency in at least two IXL skills per week (An et al., 2022) and its added value over typical IXL usage. As expected, students who met this weekly usage target outperformed their peers with lower IXL Math usage. This finding is especially relevant in the wake of the Covid-19 pandemic and the resulting learning loss, as evident in the overall decrease in SOL scores between 2021 and 2022 reported in Appendix A. Therefore, schools seeking to boost academic gains and help students overcome learning loss should encourage students to reach proficiency in at least two IXL skills per week.

Finally, the usage effects found in the full sample were also observed among student subgroups, including Black students, Hispanic students, ELL students, and special education students. Based on the present study and prior research, IXL Math supports a variety of student subgroups and is a unique and highly effective solution for schools that are specifically targeting gains in achievement for students from diverse backgrounds.

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Appendix A: Descriptive Statistics

Table A1. Student Achievement and Demographics

	n = 5,289	
Achievement	*M*	***SD***
Scale score		
2022 SOL math	408.00	60.90
2021 SOL math	419.81	57.32
Demographics	***n***	**%**
Grade		
6	1,942	36.72%
7	1,698	32.10%
8	780	14.75%
9	790	14.94%
10	58	1.10%
11	21	0.40%
Gender		
Female	2,555	48.31%
Male	2,734	51.69%
Race/Ethnicity		
Black	1582	29.91%
Hispanic	703	13.29%
Other/Multi.	1126	21.29%
White	1878	35.51%
Status		
ELL	728	13.76%
Special Education	526	9.95%

Table A2. Correlations Between 2022 SOL Math Scale Scores and IXL Usage Indicators

Variables		1	2	3	4
1	2022 SOL math	-			
2	IXL Math: questions answered	.11***	-		
3	IXL Math: skills proficient	.25***	.89***	-	
4	IXL Math: time spent (in minutes)	.11***	.79***	.71***	-

Note. n = 5,289; *** indicates significance at the .001 level.

Appendix B: Usage Effects of IXL Math Overall

Table B. Usage Effects of IXL Math on 2022 SOL Math Overall

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
Baseline model						
(Intercept)	437.20	2.63	432.08 – 442.30	-.03	166.07	< .001
2021 SOL math[1]	0.71	0.01	0.69 – 0.73	.75	74.26	< .001
Grade 6[2]	-26.58	1.41	-29.34 – -23.82	-.23	-18.84	< .001
Grade 7[2]	-15.56	1.41	-18.30 – -12.80	-.13	-11.07	< .001
Grade 9[2]	11.54	3.40	4.95 – 18.16	.07	3.40	.001
Grade 10[2]	3.24	5.31	-7.07 – 13.54	.01	0.61	.542
Grade 11[2]	7.74	7.70	-7.23 – 22.76	.01	1.01	.315
Gender: male[3]	0.15	0.88	-1.57 – 1.87	.00	0.17	.866
Race: Black[4]	-10.00	1.52	-13.00 – -7.05	-.08	-6.59	< .001
Race: Hispanic[4]	-9.21	1.67	-12.50 – -5.94	-.06	-5.51	< .001
Race: White[4]	-4.52	1.26	-6.99 – -2.05	-.04	-3.59	< .001
ELL[5]	-3.12	1.45	-5.95 – -0.27	-.02	-2.15	.032
Special education[6]	-10.30	1.54	-13.31 – -7.29	-.05	-6.71	< .001
IXL usage effects						
IXL Math: questions answered[7]	0.28	0.03	0.22 – 0.33	.08	9.56	< .001
IXL Math: skill proficient[7]	13.32	0.97	11.42 – 15.20	.12	13.79	< .001
IXL Math: time spent[7]	0.54	0.05	0.44 – 0.64	.09	10.18	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; Other/Multi. as reference group; [5] Dummy coded; non-ELLs as reference group; [6] Dummy coded; non-special education students as reference group; [7] Weekly average amount.

Appendix C: Usage Effects of IXL Math Among Middle and High School Students

Table C1. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among Middle Schoolers

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	431.03	2.99	425.07 – 436.91	-.04	144.05	< .001
2021 SOL math[1]	0.70	0.01	0.68 – 0.72	.72	68.70	< .001
Grade 6[2]	-29.25	1.42	-32.04 – -26.47	-.24	-20.56	< .001
Grade 7[2]	-17.54	1.41	-20.30 – -14.78	-.14	-12.44	< .001
Gender: male[3]	0.37	0.96	-1.51 – 2.25	.00	0.39	.699
Race: Black[4]	-10.81	1.67	-14.11 – -7.56	-.08	-6.48	< .001
Race: Hispanic[4]	-7.73	1.88	-11.42 – -4.06	-.04	-4.11	< .001
Race: White[4]	-4.13	1.34	-6.75 – -1.51	-.03	-3.09	.002
ELL[5]	-5.30	1.61	-8.45 – -2.14	-.03	-3.29	.001
Special education[6]	-12.75	1.80	-16.27 – -9.23	-.06	-7.09	< .001
IXL Math: skill proficient[7]	13.15	1.01	11.18 – 15.12	.12	13.08	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; Other/Multi. as reference group; [5] Dummy coded; non-ELLs as reference group; [6] Dummy coded; non-special education students as reference group; [7] Weekly average amount.

Table C2. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among High Schoolers

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	428.87	3.76	421.56 – 436.13	-.02	114.14	< .001
2021 SOL math[1]	0.46	0.03	0.40 – 0.52	.47	15.24	< .001
Grade 10[2]	-10.83	3.74	-18.08 – -3.47	-.08	-2.90	.004
Grade 11[2]	-8.80	6.11	-20.65 – 3.19	-.04	-1.44	.150
Gender: male[3]	1.42	1.89	-2.24 – 5.13	.02	0.75	.453
Race: Black[4]	-1.34	3.28	-7.92 – 4.97	-.02	-0.41	.683
Race: Hispanic[4]	-4.56	3.39	-11.18 – 2.03	-.06	-1.35	.178
Race: White[4]	-0.99	3.24	-7.33 – 5.31	-.01	-0.31	.760
ELL[5]	-0.91	2.90	-6.63 – 4.70	-.01	-0.31	.753
Special education[6]	-8.05	2.54	-12.96 – -3.02	-.09	-3.16	.002
IXL Math: skill proficient[7]	14.83	3.98	7.02 – 22.52	.12	3.72	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 9 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; Other/Multi. as reference group; [5] Dummy coded; non-ELLs as reference group; [6] Dummy coded; non-special education students as reference group; [7] Weekly average amount.

Appendix D: Usage Effects of IXL Math Among Students Subgroups

Table D1. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among Black Students

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	419.54	3.66	412.44 – 426.67	.05	114.50	< .001
2021 SOL math[1]	0.64	0.02	0.60 – 0.68	.61	33.03	< .001
Grade 6[2]	-31.74	2.63	-36.85 – -26.58	-.33	-12.09	< .001
Grade 7[2]	-19.44	2.72	-24.74 – -14.11	-.18	-7.16	< .001
Grade 9[2]	17.46	4.63	8.46 – 26.43	.15	3.77	< .001
Grade 10[2]	6.33	7.48	-8.15 – 20.91	.02	0.85	.398
Grade 11[2]	20.21	9.71	1.39 – 39.22	.04	2.08	.038
Gender: male[3]	0.00	1.57	-3.06 – 3.08	.00	0.00	.998
ELL[4]	-5.06	5.30	-15.37 – 5.40	-.02	-0.95	.340
Special education[5]	-11.77	2.27	-16.21 – -7.32	-.09	-5.18	< .001
IXL Math: skill proficient[6]	16.51	1.80	12.94 – 20.00	.17	9.17	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; non-ELLs as reference group; [5] Dummy coded; non-special education students as reference group; [6] Weekly average amount.

Table D2. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among Hispanic Students

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	416.29	4.47	407.69 – 424.99	.00	93.11	< .001
2021 SOL math[1]	0.69	0.03	0.63 – 0.74	.66	24.27	< .001
Grade 6[2]	-26.48	4.08	-34.44 – -18.56	-.24	-6.50	< .001
Grade 7[2]	-17.32	4.09	-25.29 – -9.37	-.15	-4.24	< .001
Grade 9[2]	16.91	5.30	6.71 – 27.14	.14	3.19	.002
Grade 10[2]	7.51	9.88	-11.71 – 26.53	.02	0.76	.448
Grade 11[2]	-1.28	15.17	-30.80 – 28.12	.00	-0.08	.933
Gender: male[3]	3.02	2.51	-1.90 – 7.90	.03	1.20	.230
ELL[4]	-3.52	2.71	-8.82 – 1.73	-.03	-1.30	.193
Special education[5]	-13.84	4.57	-22.70 – -4.88	-.07	-3.03	.003
IXL Math: skill proficient[6]	21.10	3.17	14.89 – 27.21	.18	6.66	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; non-ELLs as reference group; [5] Dummy coded; non-special education students as reference group; [6] Weekly average amount.

Table D3. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among ELL Students

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	416.14	4.95	406.61 – 425.84	-.01	84.07	< .001
2021 SOL math[1]	0.69	0.03	0.64 – 0.74	.71	26.69	< .001
Grade 6[2]	-16.79	4.01	-24.59 – -8.98	-.15	-4.18	< .001
Grade 7[2]	-14.77	4.15	-22.91 – -6.74	-.12	-3.55	< .001
Grade 9[2]	26.11	5.46	15.62 – 36.61	.19	4.79	< .001
Grade 10[2]	9.99	10.53	-10.48 – 30.28	.02	0.95	.343
Grade 11[2]	-9.47	15.42	-39.52 – 20.30	-.01	-0.61	.539
Gender: male[3]	-0.31	2.46	-5.12 – 4.46	.00	-0.13	.898
Race: Black[4]	-10.11	6.03	-21.90 – 1.56	-.04	-1.68	.094
Race: Hispanic[4]	-7.54	3.24	-13.93 – -1.30	-.07	-2.33	.020
Race: White[4]	-1.43	3.66	-8.62 – 5.64	-.01	-0.39	.696
Special education[5]	-8.74	4.34	-17.15 – -0.25	-.05	-2.01	.044
IXL Math: skill proficient[6]	19.46	2.72	14.06 – 24.70	.18	7.15	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; Other/Multi. as reference group; [5] Dummy coded; non-special education students as reference group; [6] Weekly average amount.

Table D4. Usage Effects of IXL Math on the 2022 SOL Math Assessment Among Students Enrolled in Special Education Services

Predictor	*b*	*SE*	95% CI	β	*t*	*p*
(Intercept)	416.12	7.19	402.41 – 430.08	.00	57.90	< .001
2021 SOL math[1]	0.60	0.04	0.53 – 0.68	.53	15.86	< .001
Grade 6[2]	-29.15	5.31	-39.29 – -18.67	-.28	-5.49	< .001
Grade 7[2]	-31.34	5.28	-41.43 – -20.89	-.28	-5.94	< .001
Grade 9[2]	20.58	6.23	8.71 – 32.44	.18	3.30	.002
Grade 10[2]	9.32	9.81	-9.56 – 28.11	.03	0.95	.343
Grade 11[2]	25.21	18.07	-9.53 – 60.41	.04	1.39	.164
Gender: male[3]	-1.56	3.24	-7.88 – 4.72	-.01	-0.48	.630
Race: Black[4]	-10.44	5.29	-21.32 – -0.35	-.11	-1.97	.049
Race: Hispanic[4]	-11.74	6.51	-24.48 – 0.78	-.08	-1.80	.072
Race: White[4]	-2.56	5.20	-12.66 – 7.53	-.02	-0.49	.622
ELL[5]	-0.62	5.35	-10.93 – 9.86	.00	-0.12	.907
IXL Math: skill proficient[6]	17.99	3.61	10.88 – 24.88	.17	4.98	< .001

Note. Dependent variable: Scale score on the 2022 SOL math assessment. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Grand mean-centered; [2] Dummy coded: grade 8 as reference group; [3] Dummy coded; female as reference group; [4] Dummy coded; Other/Multi. as reference group; [5] Dummy coded; non-ELLs as reference group; [6] Weekly average amount.