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IXL Implementation Fidelity and Usage Recommendations

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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 and a first-of-its-kind assessment suite. As students practice a skill on IXL, they receive questions that automatically adapt to their current knowledge level and get progressively more challenging as students continue to learn. Rooted deeply in learning sciences research (Bashkov et al., 2021), IXL is used by 24% of students in the U.S. and over 13 million students worldwide, as of this writing. Prior research has supported the impact of IXL on student learning across grades and subject areas with greater usage resulting in larger gains (e.g., An, 2021a; Bashkov, 2021; Empirical Education, 2013; Schonberg, 2021; Van Ruler, 2017).

IXL's implementation guideline for optimal usage is for students to reach proficiency in at least two skills per subject per week. This recommendation is based on both learning theory and empirical evidence. According to Locke and Latham's goal-setting theory (Locke & Latham, 1990; 2013), aiming for a specific, challenging but attainable goal like this one is related to achieving better learning outcomes. Moreover, the present empirical study found that students who reached proficiency in at least two IXL skills per week made significantly larger gains on NWEA MAP in both math and language arts compared to students with typical IXL usage. Thus, both theory and research suggest two skills proficient per week would be the optimal amount of IXL usage in each subject. This document provides an overview of the theoretical background for setting this specific usage goal and summarizes the empirical evidence for the added value of reaching proficiency in at least two skills per week over typical IXL usage.

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IXL Implementation Fidelity and Usage Recommendations

Implementation Fidelity and Target Program Exposure

To maximize the learning gains from using a learning program, it is important to ensure the program is implemented with fidelity, which is the degree to which a program is delivered as designed or intended (Finney, Wells, & Henning, 2021; Noell, Gresham, & Gansle, 2002; van Dijk et al., 2022). Commonly used indexes of implementation fidelity include adherence to intervention, exposure or dose, quality of delivery, participant responsiveness, and program differentiation (Carroll et al., 2007). Previous studies have found that better fidelity correlated with better educational program outcomes (e.g., Boticki, 2015; Hill & Erickson, 2019).

Program exposure is a key element of implementation fidelity and refers to the amount of an intervention received by participants. For students using IXL, setting a target program exposure (i.e., an IXL usage goal) both allows monitoring of implementation fidelity and enhances students' motivational and learning outcomes. This is because goal pursuit involves processes that help students focus and sustain their efforts directed toward task success (Schunk and DiBenedetto, 2020). We expand on this idea in the next section. The iterative process of perceived progress, self-efficacy, and goal pursuit is critical for motivation and learning (Schunk & DiBenedetto, 2020).

Theoretical Support for IXL's Usage Recommendation

With IXL, students achieve proficiency in a given skill when they reach a *SmartScore* of 80. IXL's SmartScore is a proprietary scoring algorithm that keeps track of student progress on a skill. It ranges from 0 to 100, with a SmartScore of 80 indicating skill proficiency, and a SmartScore of 100 indicating skill mastery (see Bashkov et al., 2021). However, it is not a percent correct score; a SmartScore of 100 is always possible. IXL efficacy research has consistently shown that striving for proficiency positively impacts students' performance on state assessments (e.g., An, 2021b; Bashkov, 2021; Empirical Education, 2013; IXL Learning, 2020; Schonberg, 2021).

IXL's proposed optimal usage guideline for students to strive to reach proficiency in at least two skills per week (2 SP/week) is based on a comprehensive analysis of various usage levels and associated outcomes (An, 2021a). This 2 SP/week implementation and usage goal encompasses a number of important characteristics (e.g., specificity, proximity, and appropriate difficulty) that are tied to achieving better learning outcomes as suggested by the literature.

First and foremost, 2 SP/week is a specific usage goal that focuses on the number of skills in which students are expected/encouraged to reach proficiency (i.e., "skills proficient"). Compared to adopting a general or vague goal, adopting a specific goal is related to better task performance (Locke & Latham, 1990; Tubbs, 1986; Schweickle et al., 2017). In addition, compared to other commonly used measures of usage in online learning programs, such as amount of time spent or number of questions answered, the number of skills proficient provides information on both how much a learner engages with the product and how much they have learned on a specific topic. In this way, students develop a sense of achievement that could then boost self-efficacy and facilitate future learning success.

Second, this goal targets the acquisition of knowledge or skills, which are different from performance goals that focus on social comparisons (e.g., doing better than other classmates). In contrast to performance goals, learning goals emphasize students' feelings of success with acquiring knowledge or skills (Nicholls et al., 1990; Schunk, 2012; Wolters, 2004), which leads to enhanced motivation and better achievements (Ames & Archer, 1988; Haracloewicz et al., 2002; White & DiBenedetto, 2017).

Third, as a short-term weekly goal, the 2 SP/week implementation goal keeps learners focused on a small achievable target that gradually moves them closer to their longer-term learning goals for the semester or the school year. Previous research has found that proximal or reachable short-term goals benefit one's motivation and learning more so than distal goals, especially for students who are facing difficulties with learning (Brown & McCracken, 2010; Manderlink & Harackiewicz, 1984).

Last but not least, reaching proficiency in two IXL skills per week is a relatively challenging but still attainable goal. Prior studies examining IXL efficacy have reported a wide range of usage levels, both above and below this target (An, 2021b; IXL Learning, 2020). As supported by the literature, setting relatively ambitious goals has been associated with higher performance relative to modest goals (Donovan, 2009; Locke & Latham, 2013; Tubbs, 1986). What this means is that this usage target is both reasonable and attainable. Prior research shows that students spend about 15-20 minutes on IXL to reach proficiency in one skill (An, 2021a). Thus, in order to achieve the goal of 2 SP/week, students will need to practice on IXL for 30-40 minutes per week, in one or more learning sessions.

Empirical Evidence Supporting IXL's Usage Recommendation

Given the importance of implementation fidelity and targeted IXL implementation based on the 2 SP/week recommendation, we conducted an empirical study to evaluate the added value of setting a targeted program exposure goal of 2 SP/week over typical implementation. Specifically, we examined the effects of IXL implementation with high fidelity (i.e., achieving the 2 SP/week) versus typical IXL implementation on student learning outcomes, controlling for baseline performance and key demographic variables. The outcome of interest was students' performance on the NWEA Measures of Academic Progress (MAP) assessments in math and English language arts (ELA). Following students for 12 weeks, the study aimed to answer the following research question: *Did students who used IXL with high fidelity outperform students who used IXL as usual?*

METHOD

We analyzed data from 1,746 students in grades 3-5 from five public elementary schools in an urban district in the Midwest United States. Fifty-three percent were boys, 54% qualified for free/reduced lunch, 14% had an Individualized Educational Plan (IEP), and 5% were English language learners (ELLs). Forty-five percent were White; 31% were Black. All students had access to IXL Math and IXL ELA in spring 2021; however, the study took place in the last 12 weeks of the semester. Students were taught by 89 teachers, 82 of whom (92%) were teaching both math and ELA.

The district provided us student academic performance and demographic data. Math and ELA achievement were measured by NWEA MAP math and reading tests. Winter 2020 MAP served as the pretest measure, with Spring 2021 MAP serving as the posttest measure. In the analysis, we examined both MAP RIT (Rasch Unit) scale scores and MAP proficiency status based on the 2020 Achievement Norms (NWEA, 2020).

Implementation fidelity was assessed via students' IXL usage data in math and ELA during the Spring 2021 semester. We calculated the number of skills in which students reached proficiency and used SP/week as the main IXL usage indicator in this study, which allowed for an empirical evaluation of IXL's usage recommendation of 2 SP/week.

The study adopted a quasi-experimental pretest-posttest control group design. Specifically, we evaluated the impact of high-fidelity IXL implementation by comparing the performance of the treatment groups (i.e., high-fidelity IXL implementation) and the comparison group (i.e., typical IXL implementation) at posttest, while accounting for pretest performance and key demographic variables.

Based on whether a student reached the 2 SP/week target in a given subject (i.e., high fidelity usage), students fell into one of four study groups: typical IXL implementation in both math and ELA (i.e., *Typical-Math/Typical-ELA* hereinafter; n = 1,066 students), high-fidelity implementation in math and typical implementation in ELA (*High-Math/Typical-ELA*; n = 385), typical implementation in math and high-fidelity implementation in ELA (*Typical-Math/High-ELA*; n = 54), and high-fidelity implementation in both math and ELA (*High-Math/High-ELA*; n = 241). Specifically, typical implementation in a given subject referred to IXL usage, on average, below 2 SP/week during the 12 weeks for that subject. High-fidelity implementation of IXL was defined as IXL usage reaching or exceeding 2 SP/week during the 12-week period. Instead of collapsing groups by subject, we opted to compare all four groups in order to evaluate potential cross-subject effects of IXL based on prior research and the significant correlations between math and ELA performance (see Table 2).

At the end of the study, we conducted an anonymous teacher survey to collect feedback regarding IXL implementation, including questions related to teacher and student motivation, teacher impact on student IXL usage, teacher perceptions of an appropriate IXL implementation target, challenges when using IXL, and an open-ended question for teachers to provide additional feedback. Forty-eight out of 89 teachers (54%) in the study responded to the survey.

RESULTS

MAP Descriptive Statistics

Across groups, the average MAP math score was 201.49 with a proficiency rate of 37.86% in winter 2020 and increased to 206.50 with a proficiency rate of 41.41% in spring 2021. In ELA, the average MAP score was 201.02 with a proficiency rate of 51.20% in winter 2020 and 202.38 with a proficiency rate of 48.28% in spring 2021 (see Table 1 in the Appendix).

Correlations between SP/week and MAP Scores

We found positive correlations between IXL usage and Spring 2021 MAP performance (see Table 2 in the Appendix). The Spring 2021 MAP math scores were positively correlated with the number of skills proficient (r = .13, p < .01) on IXL Math. For math proficiency status and IXL Math usage, the correlation was .20 (p < .01). Similarly, Spring 2021 MAP ELA scores were positively correlated with the number of skills proficient on IXL ELA (r = .15, p < .01). For ELA proficiency status and IXL ELA usage, the correlation was .22 (p < .01).

SP/week Predicting MAP Scores

Due to the clustered nature of the data (students nested within teachers) and intraclass correlation coefficients (ICCs) ranging from .19 to .41, we built multilevel models for math and ELA separately, using average SP/week to predict Spring 2021 MAP performance. In these models, we controlled for baseline performance and demographic variables, including grade, gender, race, free/reduced lunch status, IEP status, and ELL status[2].

Results showed that SP/week was a significant predictor of Spring 2021 MAP math scores (b = 0.76, p < .001), above and beyond the effects of the covariates. We found similar results for ELA (b = 0.81, p < .001); see Tables 3A and 4A in the Appendix for more details.

We also found that SP/week was a significant predictor of Spring 2021 MAP proficiency status for both math (b = 0.22, *odds ratio* = 1.24, p < .001) and ELA (b = 0.19, *odds ratio* = 1.21, p = .007). Specifically, with each additional SP/week in IXL Math and/or IXL ELA, students were about 20% more likely to reach proficiency on the corresponding MAP test. See Tables 3B and 4B in the Appendix for more details.

Study Group Comparisons

Next we built multilevel models for math and ELA separately to compare the MAP performance of the four study groups, namely *Typical-Math/Typical-ELA* (the comparison group), *High-Math/Typical-ELA, Typical-Math/High-ELA* and *High-Math/High-ELA*. In these models, we controlled for baseline performance and demographic variables, including grade, gender, race, free/reduced lunch status, IEP status, and ELL status[3].

In terms of math performance, we found the two groups using IXL Math with high fidelity had both significantly higher MAP math scores and higher probabilities of reaching MAP math proficiency after 12 weeks. Specifically, the *High-Math/Typical-ELA* group outperformed the comparison group (*Typical-Math/Typical-ELA*) by 1.94 points (p < .001, Hedges' g = 0.12) and was 1.54 times more likely to reach math proficiency (p = .046) on the MAP test. The *High-Math/High-ELA* group outperformed the comparison group by 3.13 points (p < .001, Hedges' g = 0.18) and was 2.21 times more likely to reach math proficiency (p = .002) on MAP. See Tables 5 and 6 in the Appendix for more details.

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[2] In the multilevel linear models predicting MAP RIT scores, we controlled for pretest and all available demographic variables. In the multilevel logistic models predicting MAP proficiency status, we only controlled for pretest and grade level due to model convergence issues.

Similar to our findings in math, we found that the two groups using IXL ELA with high fidelity had both significantly higher MAP reading scores and higher probabilities of reaching MAP reading proficiency after 12 weeks. Specifically, the *Typical-Math/High-ELA* group outperformed the comparison group by 2.80 points (p = .003, Hedges' g = 0.17) and was 2.85 times more likely to reach reading proficiency (p = .033) on the MAP test. The *High-Math/High-ELA* group outperformed the comparison group by 1.82 points (p = .010, Hedges' g = 0.11) and was 1.63 times more likely to reach reading proficiency (p = .028) on MAP. See Tables 7 and 8 in the Appendix for more details.

Teacher Survey

We conducted an anonymous teacher survey at the end of the study. When asked about the appropriate weekly usage goals for IXL Math and IXL ELA[4] , teachers provided responses in line with IXL's usage recommendation of 2 SP/week. For both math and ELA, the distributions peaked at 2 SP/week as optimal weekly usage (see Figure 1).

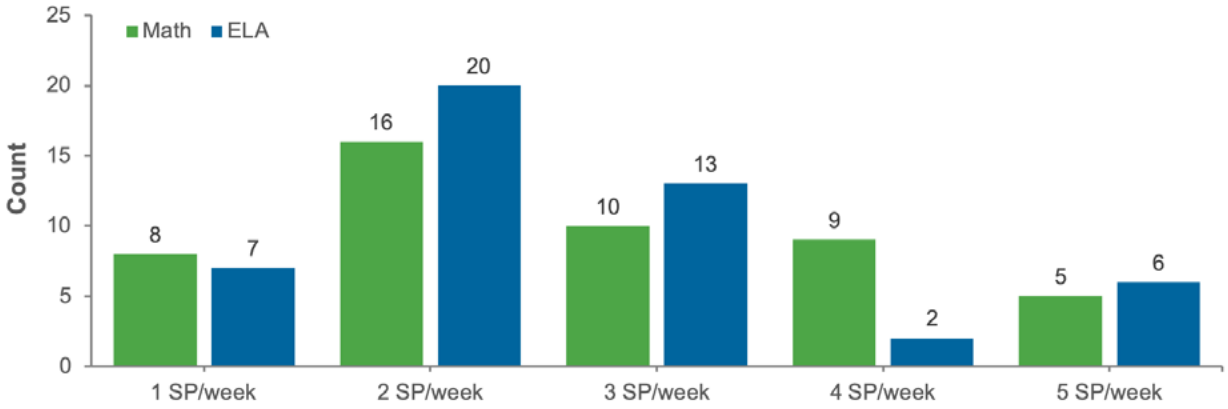

Figure 1. Distribution of teacher responses to weekly IXL usage goals

To better understand the IXL usage patterns in this study, we asked teachers a series of questions about teacher and student motivation as well as any implementation challenges they may have encountered. Ninety-eight percent of *teachers* reported they were "somewhat motivated" or "very motivated" to use IXL Math (96% for IXL ELA, respectively). The rates of teachers who reported their *students* to be "somewhat motivated" or "very motivated" to use IXL were 90% for IXL Math and 83% for IXL ELA. Overall, both teachers and students were motivated to use IXL during the study.

[3] In the multilevel linear models predicting MAP RIT scores, we controlled for pretest and all available demographic variables. In the multilevel logistic models predicting MAP proficiency status, we only controlled for pretest and grade level due to model convergence issues.

[4] Teachers responded to the prompt "One of our goals is to recommend a meaningful, yet practical amount of IXL usage for students. How many skills (per subject) per week do you think students should aim to reach proficiency in?" with options from 1 SP/week to 5 SP/week.

However, only 33% of teachers reported having “a lot of impact” on how their students used IXL, while 54% reported having “some impact”, and 13% reported having “very little or no impact”. This indicated that it may have been challenging for teachers to influence and monitor students’ IXL usage. According to teachers, the top three challenges preventing students from reaching the 2 SP/week target were: “[Students] give up” (48%), “[Students] go back and forth between several skills instead of working on only one until they reach proficiency” (38%), and “Not enough time” (31%). At the end of the survey, we left an open-ended question for teachers to provide any additional feedback. Several teachers reported that, although they liked IXL, it was difficult to monitor and encourage IXL usage with many students being remote during the COVID-19 pandemic.

Conclusion

This paper highlights the theoretical background behind IXL’s usage recommendation. It also reports the first piece of empirical evidence for the added-value of reaching 2 SP/week over typical IXL implementation on the individual student level. Building on prior research and being the first formal evaluation of IXL’s usage recommendation and its impact on student learning in math and ELA, this study offers important insights.

First, establishing a meaningful yet practical amount of weekly IXL usage results in significantly higher student performance. We were excited to see that students who reached IXL’s usage recommendation of 2 SP/week outperformed their peers after only 12 weeks of targeted implementation. Teachers’ feedback further supported this usage goal as appropriate and attainable. As such, schools seeking to boost performance in math and ELA should follow IXL’s guidelines and implement IXL with high fidelity in their classrooms.

Where possible, the 2 SP/week target should be used for both math and ELA. However, in the study, we also found potential cross-subject effects—reaching the 2 SP/week goal in one subject also boosted learning in the other subject (see Tables 5A and 6B in the Appendix). One possible explanation is related to student motivation. As discussed earlier, the usage goal of 2 SP/week itself represents a type of learning achievement, which may boost a learner’s overall self-efficacy and motivation to learn, and eventually leads to better academic performance in all subjects. A closer inspection of this potential explanation is warranted to shed more light on the cross-subject effects of IXL.

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Appendix

Table 1. **MAP performance in winter 2020 and spring 2021**

	n	missing	*M*	*SD*	Min	Max	Proficiency (%)
MAP Math: Winter 2020	1694	52	201.49	15.496	133	254	37.86
MAP Math: Spring 2021	1679	67	206.50	16.345	137	260	41.41
MAP ELA: Winter 2020	1691	55	201.02	16.972	135	245	51.20
MAP ELA: Spring 2021	1675	71	202.38	16.483	145	250	48.28

Table 2. Correlations between weekly IXL usage and MAP performance

		1	2	3	4	5	6	7	8	9
1	IXL Math: Skills proficient	--								
2	IXL ELA: Skills proficient	.63**	--							
3	MAP Math: Winter 2020 RIT Score	.06*	.05	--						
4	MAP Math: Winter 2020 Proficiency	.14**	.17**	.66**	--					
5	MAP Math: Spring 2021 RIT Score	**.13****	**.10****	.89**	.62**	--				
6	MAP Math: Spring 2021 Proficiency	**.20****	**.21****	.58**	.71**	.71**	--			
7	MAP ELA: Winter 2020 RIT Score	.08**	.13**	.79**	.55**	.76**	.52**	--		
8	MAP ELA: Winter 2020 Proficiency	.14**	.21**	.54**	.56**	.54**	.54**	.73**	--	
9	MAP ELA: Spring 2021 RIT Score	**.10****	**.15****	.76**	.54**	.78**	.55**	.87**	.63**	--
10	MAP ELA: Spring 2021 Proficiency	**.15****	**.22****	.50**	.53**	.55**	.55**	.61**	.66**	.73**

Note. *: $p < .05$; **: $p < .01$

Table 3A. Multilevel model: IXL Math (SP/week) predicting Spring 2021 MAP Math score

	b	*SE*	95% CI		β	*t*	*p*
(Intercept)	206.83	0.72	205.43	– 208.23	0.01	287.93	< .001
Grade: 3[1]	-1.37	0.79	-2.91	– 0.17	-0.04	-1.73	.086
Grade: 4[1]	-0.93	0.71	-2.31	– 0.45	-0.03	-1.31	.194
Gender: male[2]	1.19	0.35	0.51	– 1.88	0.04	3.39	.001
Race: White[3]	0.13	0.46	-0.77	– 1.04	0.00	0.27	.784
Race: Black[3]	-2.02	0.50	-2.99	– -1.05	-0.06	-4.07	< .001
Free/Reduced lunch	-0.66	0.36	-1.36	– 0.05	-0.02	-1.81	.070
IEP	-4.22	0.58	-5.35	– -3.09	-0.09	-7.30	< .001
ELL	-1.15	0.91	-2.91	– 0.63	-0.02	-1.27	.204
MAP Math: Winter 2020 RIT[4]	0.85	0.02	0.82	– 0.89	0.80	51.22	< .001
SP/week on IXL Math	**0.76**	**0.11**	**0.55**	**– 0.98**	**0.09**	**6.93**	**< .001**

Note. b = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient, SP/week = skills proficient per week (i.e., the average number of skills in which students reached proficiency per week).

[1] Dummy coded; grade 5 as reference group.

[2] Dummy coded; female as reference group.

[3] Dummy coded; other races as reference group.

[4] Grand-mean centered.

Table 3B. Multilevel logistic model: IXL Math (SP/week) predicting Spring 2021 MAP Math proficiency status

	b	*SE*	95% CI		β	*t*	*p*
(Intercept)	-3.77	0.28	-4.35	– -3.24	-0.90	-13.32	< .001
Grade: 3[1]	5.08	0.40	4.33	– 5.89	2.40	12.82	< .001
Grade: 4[1]	2.14	0.29	1.56	– 2.73	1.01	7.25	< .001
MAP Math: Winter 2020 RIT[2]	0.28	0.02	0.25	– 0.31	4.30	18.26	< .001
SP/week on IXL Math	**0.22**	**0.05**	**0.12**	**– 0.32**	**0.43**	**4.06**	**< .001**

Note. Due to model convergence issues, we only controlled for pretest and the grade level. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient, SP/week = skills proficient per week (i.e., the average number of skills in which students reached proficiency per week).

[1] Dummy coded; grade 5 as reference group.

[2] Grand-mean centered.

Table 4A. Multilevel model: IXL ELA (SP/week) predicting Spring 2021 MAP ELA score

	b	*SE*	95% CI	β	*t*	*p*
(Intercept)	203.21	0.70	201.85 – 204.57	0.00	290.10	< .001
Grade: 3[1]	-1.80	0.66	-3.07 – -0.52	-0.05	-2.74	.007
Grade: 4[1]	-0.91	0.59	-2.06 – 0.24	-0.03	-1.53	.128
Gender: male[2]	0.20	0.40	-0.58 – 0.98	0.01	0.51	.613
Race: White[3]	0.83	0.52	-0.18 – 1.86	0.03	1.59	.113
Race: Black[3]	-0.85	0.56	-1.94 – 0.25	-0.02	-1.53	.127
Free/Reduced lunch	-0.55	0.41	-1.36 – 0.25	-0.02	-1.34	.182
IEP	-4.84	0.67	-6.14 – -3.54	-0.10	-7.26	< .001
ELL	-1.31	1.01	-3.29 – 0.67	-0.02	-1.29	.198
MAP ELA: Winter 2020 RIT[4]	0.77	0.02	0.74 – 0.80	0.78	47.99	< .001
SP/week on IXL ELA	**0.81**	**0.20**	**0.41 – 1.21**	**0.06**	**3.99**	**< .001**

Note. b = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient, SP/week = skills proficient per week (i.e., the average number of skills in which students reached proficiency per week).

[1] Dummy coded; grade 5 as reference group.

[2] Dummy coded; female as reference group.

[3] Dummy coded; other races as reference group.

[4] Grand-mean centered.

Table 4B. Multilevel logistic model: IXL ELA (SP/week) predicting Spring 2021 MAP ELA proficiency status

	b	*SE*	95% CI	β	*t*	*p*
(Intercept)	-1.80	0.16	-2.12 – -1.48	-0.20	-11.08	< .001
Grade: 3[1]	2.84	0.25	2.35 – 3.32	1.34	11.50	< .001
Grade: 4[1]	1.24	0.19	0.86 – 1.62	0.59	6.41	< .001
MAP ELA: Winter 2020 RIT[2]	0.18	0.01	0.17 – 0.20	3.10	19.27	< .001
SP/week on IXL ELA	**0.19**	**0.07**	**0.05 – 0.34**	**0.21**	**2.67**	**.007**

Note. Due to model convergence issues, we only controlled for pretest and the grade level. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient, SP/week = skills proficient per week (i.e., the average number of skills in which students reached proficiency per week).

[1] Dummy coded; grade 5 as reference group.

[2] Grand-mean centered.

Table 5. **Multilevel model: Usage group comparisons for Spring 2021 MAP Math score**

	b	*SE*	95% CI	β	*t*	*p*
(Intercept)	207.20	0.72	205.81 – 208.60	0.01	288.37	< .001
Grade: 3[1]	-1.27	0.80	-2.82 – 0.28	-0.04	-1.59	.115
Grade: 4[1]	-0.60	0.71	-1.97 – 0.78	-0.02	-0.84	.401
Gender: male[2]	1.28	0.35	0.59 – 1.97	0.04	3.62	< .001
Race: White[3]	0.12	0.46	-0.79 – 1.03	0.00	0.25	.804
Race: Black[3]	-2.08	0.50	-3.06 – -1.11	-0.06	-4.18	< .001
Free/Reduced lunch	-0.70	0.36	-1.41 – 0.01	-0.02	-1.92	.056
IEP	-4.19	0.58	-5.32 – -3.05	-0.09	-7.21	< .001
ELL	-1.15	0.91	-2.93 – 0.64	-0.02	-1.27	.206
MAP Math: Winter 2020 RIT[4]	0.86	0.02	0.82 – 0.89	0.80	51.25	< .001
High Math/Typical ELA[5]	**1.94**	**0.49**	**0.99 – 2.89**	**0.05**	**3.98**	**< .001**
Typical Math/High ELA[5]	3.36	1.14	1.12 – 5.58	0.04	2.94	.003
High Math/High ELA[5]	**3.13**	**0.61**	**1.93 – 4.31**	**0.07**	**5.15**	**< .001**

Note. *b* = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient, SP/week = skills proficient per week (i.e., the average number of skills in which students reached proficiency per week).

[1] Dummy coded; grade 5 as reference group.

[2] Dummy coded; female as reference group.

[3] Dummy coded; other races as reference group.

[4] Grand-mean centered.

[5] Dummy coded; *Typical Math/Typical ELA* as reference group.

Table 6. Multilevel logistic model: Usage group comparisons for Spring 2021 MAP Math proficiency status

	b	*SE*	95% CI		β	*t*	*p*
(Intercept)	-3.60	0.27	-4.14	-3.07	-0.90	-13.23	< .001
Grade: 3[1]	5.11	0.40	4.33	5.88	2.41	12.93	< .001
Grade: 4[1]	2.21	0.29	1.64	2.78	1.04	7.61	< .001
MAP Math: Winter 2020 RIT[2]	0.28	0.02	0.25	0.31	4.30	18.32	< .001
High Math/Typical ELA[3]	**0.44**	**0.22**	**0.01**	**0.86**	**0.18**	**1.99**	**.046**
Typical Math/High ELA[3]	0.51	0.50	-0.47	1.49	0.09	1.02	.306
High Math/High ELA[3]	**0.79**	**0.26**	**0.28**	**1.30**	**0.28**	**3.06**	**.002**

Note. b = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Dummy coded; grade 5 as reference group.

[2] Grand-mean centered.

[3] Dummy coded; *Typical Math/Typical ELA* as reference group.

Table 7. Multilevel model: Usage group comparisons for Spring 2021 MAP ELA score

	b	*SE*	95% CI	β	*t*	*p*
(Intercept)	203.44	0.70	202.09 – 204.80	0.00	291.53	< .001
Grade: 3[1]	-1.66	0.65	-2.92 – -0.41	-0.05	-2.56	.012
Grade: 4[1]	-0.74	0.59	-1.87 – 0.40	-0.02	-1.25	.213
Gender: male[2]	0.19	0.40	-0.59 – 0.96	0.01	0.46	.642
Race: White[3]	0.78	0.52	-0.23 – 1.81	0.02	1.50	.135
Race: Black[3]	-0.92	0.56	-2.01 – 0.18	-0.03	-1.65	.100
Free/Reduced lunch	-0.59	0.41	-1.40 – 0.21	-0.02	-1.44	.151
IEP	-4.80	0.67	-6.11 – -3.50	-0.10	-7.19	< .001
ELL	-1.28	1.02	-3.27 – 0.70	-0.02	-1.26	.208
MAP ELA: Winter 2020 RIT[4]	0.77	0.02	0.74 – 0.80	0.79	48.35	< .001
High Math/Typical ELA[5]	1.01	0.52	-0.01 – 2.00	0.03	1.95	.052
Typical Math/High ELA[5]	**2.80**	**1.21**	**0.44 – 5.15**	**0.03**	**2.32**	**.021**
High Math/High ELA[5]	**1.82**	**0.64**	**0.56 – 3.05**	**0.04**	**2.85**	**.004**

Note. b = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Dummy coded; grade 5 as reference group.

[2] Dummy coded; female as reference group.

[3] Dummy coded; other races as reference group.

[4] Grand-mean centered.

[5] Dummy coded; *Typical Math/Typical ELA* as reference group.

Table 8. Multilevel logistic model: Usage group comparisons for Spring 2021 MAP ELA proficiency status

	b	*SE*	95% CI		β	*t*	*p*
(Intercept)	-1.81	0.17	-2.14	-1.49	-0.20	-10.88	< .001
Grade: 3[1]	2.84	0.25	2.37	3.34	1.34	11.54	< .001
Grade: 4[1]	1.26	0.19	0.88	1.65	0.60	6.50	< .001
MAP ELA: Winter 2020 RIT[2]	0.19	0.01	0.17	0.21	3.12	19.33	< .001
High Math/Typical ELA[3]	0.38	0.18	0.04	0.73	0.16	2.14	.032
Typical Math/High ELA[3]	**1.05**	**0.49**	**0.12**	**2.06**	**0.18**	**2.13**	**.033**
High Math/High ELA[3]	**0.49**	**0.22**	**0.06**	**0.93**	**0.17**	**2.20**	**.028**

Note. b = unstandardized regression coefficient, *SE* = standard error, CI = confidence interval, β = standardized regression coefficient.

[1] Dummy coded; grade 5 as reference group.

[2] Grand-mean centered.

[3] Dummy coded; *Typical Math/Typical ELA* as reference group.