RESEARCH REPORT

February 2024

The Impact of IXL on Math Learning in an Ontario District School Board

Christina Schonberg, Ph.D.

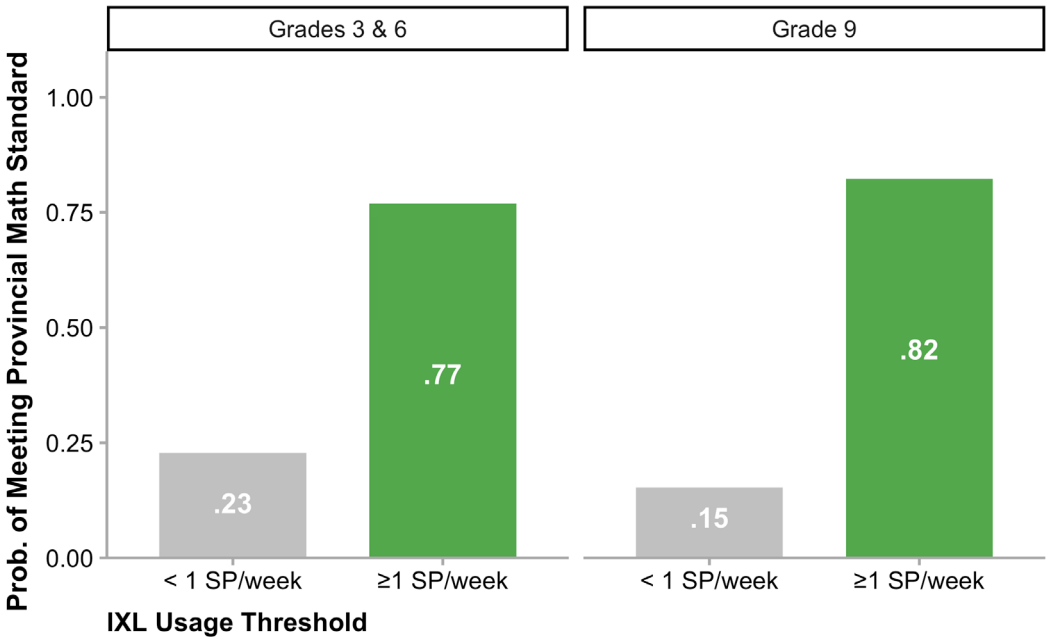
IXL LEARNING 777 Mariners Island Blvd., Suite 600, San Mateo, CA 94404
650-372-4040 | www.ixl.com

Executive Summary

IXL is an end-to-end teaching and learning solution that engages Canadian learners in grades K through 12 with a comprehensive curriculum and personalized recommendations for meeting learning goals. Previous research has shown that IXL can have a significant positive impact on students' academic performance (Bashkov, 2021; Copeland et al., 2023; Empirical Education, 2013).

The goal of this study was to examine IXL usage among students in grades 3, 6, and 9 in an Ontario district school board and its relation to their math achievement, as measured by the Ontario Education Quality and Accountability Office (EQAO) Assessment of Mathematics. Using a pretest-posttest design, we found:

- **Using IXL with fidelity was associated with better EQAO math assessment performance.** Students who reached proficiency[1] in at least 1 IXL Math skill per week (SP/week) were significantly more likely to meet the provincial math standard than students who did not meet this IXL usage threshold.



- **All students benefit from IXL.** Subgroup analyses showed that students enrolled in special education services and First Nation, Métis, or Inuit (FNMI) students who used IXL all outperformed their peers who had access but did not meet the 1 SP/week usage threshold.

[1] *Note. Skill proficiency is indicated by a SmartScore of 80+*

The Impact of IXL on Math Learning in an Ontario District School Board

Background

IXL is an end-to-end teaching and learning solution that engages learners in grades K through 12 with a comprehensive curriculum, first-of-its-kind assessment suite, and personalized recommendations for meeting learning goals. In Canada, IXL covers three main subject areas: mathematics, English, and science. As of this writing, IXL is used by 15 million students and by over 1 million educators worldwide. IXL is deeply rooted in learning sciences research (see Bashkov et al., 2021) and 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.

Prior research, including an independent randomized control trial (Copeland et al., 2023), has consistently reported significant, positive effects of IXL on student learning. The goal of the present study was to examine the impact of IXL usage on math achievement among students in grades 3, 6, and 9. Specifically, we examined the impact of IXL Math on student performance on the Ontario Education Quality and Accountability Office (EQAO) Assessment of Mathematics among students in one Ontario English Catholic district school board.

RESEARCH QUESTIONS

In two analyses, we aimed to answer the following research questions:

1. **Implementation fidelity and efficacy of IXL[2]:**
    a. Controlling for baseline performance and demographics, how did grade 3 and grade 6 students who met IXL's recommended usage thresholds perform on the EQAO Assessment of Mathematics compared to students who did not meet them?
    b. Controlling for baseline performance and demographics, how did grade 9 students who met IXL's recommended usage thresholds perform on the EQAO Assessment of Mathematics compared to students who did not meet them?

2. **Implementation fidelity and efficacy by student subgroup:** To what extent do the analyses above hold for students enrolled in special education services and First Nation, Métis, or Inuit (FNMI) students?

[2] *Students in grades 3 and 6 complete the EQAO Assessment of Mathematics at the end of the academic year; students in grade 9 complete the EQAO Grade 9 Assessment of Mathematics at the end of a one-semester math course (winter or spring). Due to the shorter length of the 9th-grade intervention period (i.e., one semester), these data were analyzed separately.*

Study Design and Methodology

DATA SOURCES

Assessment and Demographic Data

The participating district school board provided student-level demographic information and Spring 2023 assessment performance data. The EQAO Assessment of Mathematics is administered to students in grade 3 (Primary Division) and grade 6 (Junior Division) as an end-of-year assessment. Students in grade 9 complete the EQAO Grade 9 Assessment of Mathematics at the end of the semester in which they take the Ontario Grade 9 mathematics course (MTH1W). EQAO Assessment of Mathematics performance levels range from 0-4, with levels 3 and 4 indicating that a student has met the provincial standard for mathematics achievement. For more information about the EQAO assessments, see the EQAO assessments homepage.

IXL Usage and Diagnostic Data

IXL usage data were obtained from IXL's 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 recommends that students should aim to reach proficiency in at least two on-grade-level skills per week (SP/week; An et al., 2022).

IXL Real-Time Diagnostic data were also obtained from IXL's database. When a student completes a sufficient number of questions in a subject (math or English) in IXL's Diagnostic, they receive a pinpointed score that indicates their overall grade-level proficiency in that subject. For example, a score of 550 indicates that the student has acquired about 50% of grade 5 material, whereas a score of 600 indicates that the student is ready to learn grade 6 material. Students' IXL Diagnostic scores in math from the beginning of the 2022-23 academic year were used as measures of baseline performance in the analysis. For ninth-graders who took their math course in the spring, we used midyear diagnostic scores to account for baseline math proficiency.

PARTICIPANTS

We included data from students with any amount of IXL usage in the 2022-23 school year as well as non-missing pretest and posttest data. The sample size for Research Question 1a (grades 3 and 6) was 397 students, and the sample size for Research Question 1b (grade 9) was 105 students. Overall, the student sample was 53.2% male, 8.2% English language learners (i.e., did not learn English as a first language at home), and 27.7% receiving special education services. In addition, 18.3% of the sample identified as First Nation, Métis, or Inuit. Descriptive statistics of students' IXL usage are reported in Table 1, and descriptive statistics of students' pretest and posttest performance are presented in Table A1 (Appendix A) .

Table 1. **Students' IXL Usage During the Study Period**

Weekly IXL usage	Grades 3 and 6 (*n* = 397)				Grade 9 (*n* = 105)			
	M	*SD*	Min	Max	*M*	*SD*	Min	Max
Questions answered	43.07	30.93	0.00	177.78	45.23	35.42	0.00	200.75
Skills proficient	1.07	0.91	0.00	5.95	1.15	1.28	0.00	9.94
Time spent (in minutes)	14.79	8.94	0.00	56.14	26.25	19.58	0.00	97.91

Note. M = mean, *SD* = standard deviation.

ANALYSIS

We used students' proficiency status, indicated by their overall EQAO Mathematics level, as the outcome variable in all analyses. Students with overall levels of 0-2 were classified as not proficient (i.e., not meeting the provincial standard), and students with overall levels of 3-4 were classified as proficient. We then specified and tested separate logistic regression models for each research question.

Each model regressed students' binary EQAO math assessment proficiency status on an IXL predictor and covariates. The IXL predictor was a binary variable that indicated whether a student had or had not met a usage threshold of 1 SP/week. Where sample size allowed, we also tested a model using a threshold of 2 SP/week (IXL's high-fidelity usage recommendation; An et al., 2022). Following What Works Clearinghouse (WWC) guidelines (WWC, 2022), each model included the following covariates: baseline performance (measured by the IXL Real-Time Diagnostic), gender, ethnicity (i.e., FNMI status), and special education status. The models for students in grades 3 and 6 also included grade level as a covariate.

Following WWC (2022) guidelines, each effect is accompanied by a test of statistical significance using a probability (*p*) value and a measure of effect size. 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, with *p*-values less than .05 considered statistically significant.

Results

RESEARCH QUESTION 1A: IMPLEMENTATION FIDELITY AND EFFICACY IN GRADES 3 AND 6

We found that students who met or exceeded the 1 SP/week IXL Math usage threshold were more likely to pass the EQAO Assessment of Mathematics than students who may have used IXL but did not meet this threshold (see Figure 1, left panel). Specifically, we found that students who met the 1 SP/week IXL Math usage threshold (*n* = 161) were about 3.5 times more likely to achieve the provincial standard than students who did not meet this threshold (*n* = 236) [*odds ratio* = 3.55, *p* < .001]. When we examined the 2 SP/week IXL Math usage threshold, we found an even stronger

effect: students who reached at least 2 SP/week in IXL Math (*n* = 45) were about 4.4 times more likely to achieve the provincial standard than students who did not meet this threshold (*n* = 352) [*odds ratio* = 4.35, *p* < .001]. Full model results are presented in Tables A2 and A3 (Appendix A).

RESEARCH QUESTION 1B: IMPLEMENTATION FIDELITY AND EFFICACY IN GRADE 9

We found that grade 9 students who met or exceeded the 1 SP/week IXL Math usage threshold were more likely to pass the EQAO Assessment of Mathematics than students who may have used IXL but did not meet this threshold (see Figure 1, right panel). Specifically, we found that students who met the 1 SP/week IXL Math usage threshold (n = 46) were about 4.5 times more likely to achieve the provincial standard than students who did not meet this threshold (n = 59) [odds ratio = 4.46, p = .017]. Full model results are presented in Table A4 (Appendix A).

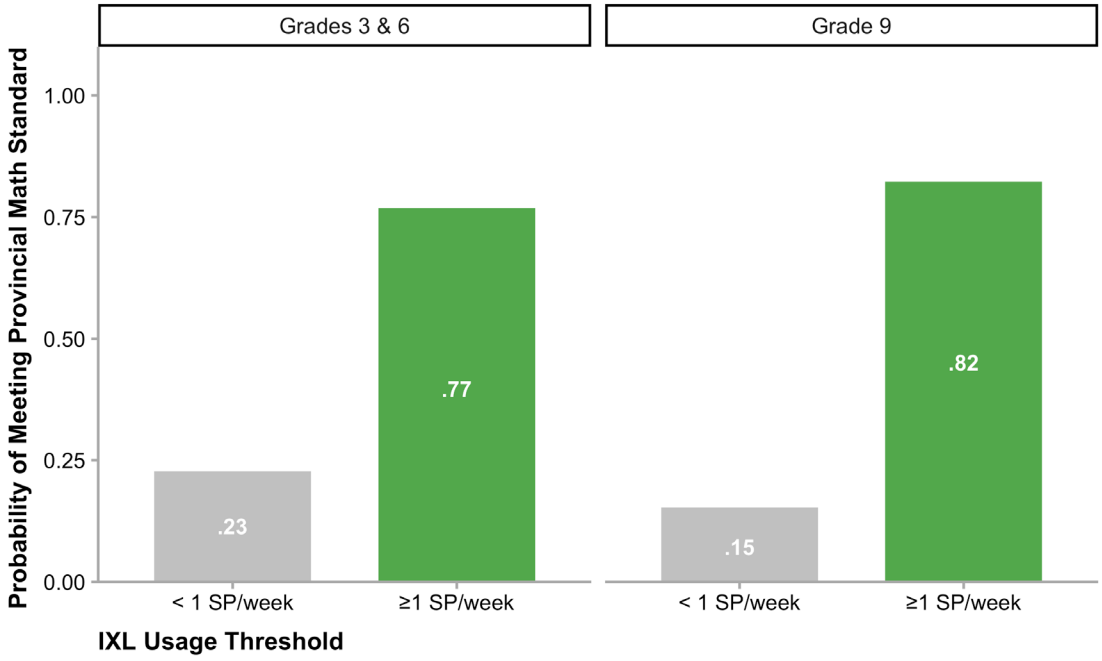


Figure 1. Effects of IXL Math when implemented at < 1 SP/week vs. ≥ 1 SP/week[3]

Note: SP/week = skills proficient per week

[3] *For ease of interpretation, the probabilities shown in Figure 1 were derived from odds ratios output by logistic regression models that regressed EQAO assessment proficiency status on only the binary IXL predictor. The odds ratios produced by these reduced models were extremely similar to those produced by the full models.*

RESEARCH QUESTION 2: IMPLEMENTATION FIDELITY AND EFFICACY BY STUDENT SUBGROUP

Grades 3 and 6

Among students receiving special education services and FNMI students, we found similar effects of IXL usage as in the main analyses. Students receiving special education services who met or exceeded the 1 SP/week IXL Math usage threshold (n = 37) were nearly 7 times more likely to achieve the provincial standard than their peers who did not meet this threshold (n = 76) [*odds ratio* = 6.78, $p < .001$]. Similarly, among students who indicated that they identified as FNMI, those who met or exceeded the 1 SP/week IXL Math usage threshold (n = 30) were nearly 7 times more likely to achieve the provincial standard than their peers who did not meet this threshold (n = 47) [*odds ratio* = 6.78, $p < .001$]. Full model results are presented in Tables A5 and A6 (Appendix A).

Grade 9

Because of the small sample sizes for students receiving special education services and FNMI students in grade 9, we examined only descriptive statistics within each group. Students receiving special education services who met or exceeded the 1 SP/week IXL Math usage threshold (n = 18) had an average EQAO math assessment level of 1.89 (SD = 0.58), while their peers who did not meet this threshold (n = 8) had an average level of 1.62 (SD = 0.52). FNMI students who met or exceeded the 1 SP/week IXL Math usage threshold (n = 9) had an average level of 2.11 (SD = 0.78) on the EQAO math assessment, while their peers who did not meet this threshold (n = 6) had an average level of 1.67 (SD = 0.52).

Discussion and Recommendations

In this study, we investigated how IXL Math usage among upper elementary, middle, and high school students related to their performance on the EQAO Assessment of Mathematics. Controlling for baseline performance and demographics, we found that students who used IXL with fidelity outperformed those who did not. These results add to the body of work showing that IXL boosts student achievement (e.g., An, 2023; Bashkov, 2021; Copeland et al., 2023; Hargis, 2023; Schonberg, 2022; Xiong, 2022).

In this school board, students' average usage of IXL Math was slightly lower than IXL's recommendation of reaching proficiency in two skills per week (An et al., 2022). Nonetheless, across multiple grade levels and student subgroups, we found that students who met or exceeded a 1 SP/week usage threshold were significantly more likely to meet the grade-level standard on the EQAO math assessment than students who did not. In Research Question 1a, we found that students who met or exceeded IXL's recommended 2 SP/week threshold were even more likely (relative to the 1 SP/week threshold) to meet the grade-level standard than students who did not meet this threshold. This finding is consistent with prior research, which has shown that interventions are more effective when they are carried out with fidelity (see Finney et al., 2021; Noell et al., 2002). We recommend that educators continue their promising implementation of IXL Math and support increased usage by encouraging students to reach proficiency in at least two skills per week.

Taken together, these results show that IXL is a powerful education platform that significantly boosts student learning. IXL's personalized approach is especially important as students continue to recover from the educational impacts of the COVID-19 pandemic, because personalized learning can both help students close existing knowledge gaps and boost future learning gains (Kaffenberger, 2021). To optimize students' personalized skill recommendations, we highly recommend that students regularly complete IXL's Real-Time Diagnostic, an interim assessment that pinpoints current knowledge levels in key strands of math and English. The diagnostic integrates seamlessly with IXL's comprehensive curriculum by generating personalized action plans based on students' performance that provide them with a list of the exact skills they should work on next. With IXL's personalized support, students can confidently unlock their academic potential and fully prepare for every learning milestone along the way.

References

An, X. (2023). *The impact of IXL Math on middle and high school math learning in a Virginia school district* (pp. 1–17). https://www.ixl.com/materials/us/research/The_Impact_of_IXL_Math_on_Middle_and_High_School_Math_(VA).pdf

An, X., Schonberg, C., & Bashkov, B. M. (2022). *IXL implementation fidelity and usage recommendations* (pp. 1–17). https://www.ixl.com/materials/us/research/IXL_Implementation_Fidelity_and_Usage_Recommendations.pdf

Bashkov, B. M. (2021). *Assessing the impact of IXL Math over three years: A quasi-experimental study* (pp. 1–11). 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. 1–16). https://www.ixl.com/research/IXL_Design_Principles.pdf

Cohen, J. (1994). The earth is round ($p < .05$). *American Psychologist, 49*(12), 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).

Hargis, M. B. (2023). *The impact of IXL on Smarter Balanced Assessment performance in math and ELA* (pp. 1–12). https://www.ixl.com/materials/us/research/The_Impact_of_IXL_on_SBA_in_Math_and_ELA.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

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.

Schonberg, C. (2022). *The impact of IXL on math and ELA learning in Georgia* (pp. 1–14). https://www.ixl.com/materials/us/research/The_Impact_of_IXL_in_Georgia_(2022).pdf

What Works Clearinghouse. (2022). *What Works Clearinghouse procedures and standards handbook, version 5.0*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance (NCEE). This report is available on the What Works Clearinghouse website at https://ies.ed.gov/ncee/wwc/Handbooks

Xiong, Y. (2022). *The impact of IXL on ELA learning in Iowa* (pp. 1–11). https://www.ixl.com/materials/us/research/Impact_of_IXL_in_Iowa.pdf

Appendix A: Pretest and Posttest Performance Descriptives

Table A1. Means (Standard Deviations) of Students' Math Pretest and Posttest Performance

Grade	IXL Real-Time Diagnostic math score (Pretest)	EQAO Assessment of Mathematics level (Posttest)
3	213.75 (81.84)	2.27 (0.81)
6	393.33 (121.17)	2.10 (0.74)
9	587.33 (156.85)	2.17 (0.67)

Table A2. Full Model Predicting Spring 2023 EQAO Assessment of Mathematics Proficiency Status Among Grade 3 and Grade 6 Students from Use of IXL Math at 1 SP/Week and Covariates

Predictor	β	*SE* β	*z*	*p*	OR	OR 95% CI
(Intercept)	0.49	0.29	1.673	.094	1.634	0.92 – 2.90
Gender: male[1]	0.21	0.27	0.779	.436	1.234	0.73 – 2.09
Ethnicity: FNMI[2]	-0.39	0.35	-1.112	.266	0.676	0.34 – 1.35
Special education[3]	-0.90	0.38	-2.385	.017	0.408	0.20 – 0.85
Grade: 6[4]	-3.60	0.49	-7.300	<.001	0.027	0.01 – 0.07
Fall 2022 diagnostic score[5]	0.01	0.00	7.224	<.001	1.014	1.01 – 1.02
≥ 1 SP/week[6]	**1.27**	**0.27**	**4.670**	**<.001**	**3.549**	**2.09 – 6.04**

Note. Dependent variable: Spring 2023 EQAO Assessment of Mathematics proficiency status (0 = did not meet provincial standard, 1 = met or surpassed provincial standard). β = logistic regression coefficient, *SE* β = standard error, OR = odds ratio, CI = confidence interval, SP = skills proficient

[1] Dummy coded; male as reference group
[2] Dummy coded; non-FNMI students as reference group
[3] Dummy coded; non-special education students as reference group
[4] Dummy coded; grade 3 as reference group
[5] Grand-mean centered
[6] Dummy coded; students reaching < 1 IXL Math SP/week as reference group

Table A3. Full Model Predicting Spring 2023 EQAO Assessment of Mathematics Proficiency Status Among Grade 3 and Grade 6 Students from Use of IXL Math at 2 SP/Week and Covariates

Predictor	β	*SE* β	*z*	*p*	OR	OR 95% CI
(Intercept)	0.82	0.27	2.980	.003	2.264	1.32 – 3.88
Gender: male[1]	0.16	0.26	0.610	.542	1.175	0.70 – 1.97
Ethnicity: FNMI[2]	-0.19	0.35	-0.547	.584	0.827	0.42 – 1.63
Special education[3]	-1.03	0.38	-2.726	.006	0.356	0.17 – 0.75
Grade: 6[4]	-3.44	0.48	-7.205	<.001	0.032	0.01 – 0.08
Fall 2022 diagnostic score[5]	0.01	0.00	7.112	<.001	1.013	1.01 – 1.02
≥ 2 SP/week[6]	**1.47**	**0.42**	**3.459**	**.001**	**4.348**	**1.89 – 10.00**

Note. Dependent variable: Spring 2023 EQAO Assessment of Mathematics proficiency status (0 = did not meet provincial standard, 1 = met or surpassed provincial standard). β = logistic regression coefficient, *SE* β = standard error, OR = odds ratio, CI = confidence interval, SP = skills proficient
[1] Dummy coded; male as reference group
[2] Dummy coded; non-FNMI students as reference group
[3] Dummy coded; non-special education students as reference group
[4] Dummy coded; grade 3 as reference group
[5] Grand-mean centered
[6] Dummy coded; students reaching < 2 IXL Math SP/week as reference group

Table A4. Full Model Predicting 2023 EQAO Assessment of Mathematics Proficiency Status Among Grade 9 Students from Use of IXL Math at 1 SP/Week and Covariates

Predictor	β	*SE* β	*z*	*p*	OR	OR 95% CI
(Intercept)	-2.57	0.70	-3.669	<.001	0.076	0.02 – 0.30
Gender: male[1]	1.42	0.69	2.070	.038	4.155	1.08 – 16.00
Ethnicity: FNMI[2]	-0.45	0.88	-0.511	.610	0.640	0.12 – 3.56
Special education[3]	-2.17	0.94	-2.310	.021	0.115	0.02 – 0.72
Pretest diagnostic score[4]	0.01	0.00	4.156	<.001	1.012	1.01 – 1.02
≥ 1 SP/week[5]	**1.50**	**0.63**	**2.376**	**.017**	**4.461**	**1.30 – 15.31**

Note. Dependent variable: 2023 EQAO Assessment of Mathematics proficiency status (0 = did not meet provincial standard, 1 = met or surpassed provincial standard). β = logistic regression coefficient, *SE* β = standard error, OR = odds ratio, CI = confidence interval, SP = skills proficient
[1] Dummy coded; male as reference group
[2] Dummy coded; non-FNMI students as reference group
[3] Dummy coded; non-special education students as reference group
[4] Grand-mean centered
[5] Dummy coded; students reaching < 1 IXL Math SP/week as reference group

Table A5. Full Model Predicting Spring 2023 EQAO Assessment of Mathematics Proficiency Status Among Grade 3 and Grade 6 SPED Students from Use of IXL Math at 1 SP/Week and Covariates

Predictor	β	*SE* β	*z*	*p*	OR	OR 95% CI
(Intercept)	1.12	0.94	1.199	0.231	3.068	0.49 – 19.18
Gender: male[1]	-0.58	0.79	-0.728	0.467	0.562	0.12 – 2.65
Ethnicity: FNMI[2]	-0.75	1.01	-0.747	0.455	0.471	0.07 – 3.39
Grade: 6[3]	-6.37	1.83	-3.475	0.001	0.002	0.00 – 0.06
Fall 2022 diagnostic score[4]	0.02	0.01	2.985	0.003	1.019	1.01 – 1.03
≥ 1 SP/week[5]	**1.91**	**0.91**	**2.100**	**0.036**	**6.781**	**1.14 – 40.48**

Note. Dependent variable: 2023 EQAO Assessment of Mathematics proficiency status (0 = did not meet provincial standard, 1 = met or surpassed provincial standard). β = logistic regression coefficient, *SE* β = standard error, OR = odds ratio, CI = confidence interval, SP = skills proficient
[1] Dummy coded; male as reference group
[2] Dummy coded; non-FNMI students as reference group
[3] Dummy coded; grade 3 as reference group
[4] Grand-mean centered
[5] Dummy coded; SPED students reaching < 1 IXL Math SP/week as reference group

Table A6. Full Model Predicting Spring 2023 EQAO Assessment of Mathematics Proficiency Status Among Grade 3 and Grade 6 FNMI Students from Use of IXL Math at 1 SP/Week and Covariates

Predictor	β	*SE* β	*z*	*p*	OR	OR 95% CI
(Intercept)	-0.06	0.64	-0.088	.930	0.945	0.27 – 3.32
Gender: male[1]	-0.46	0.67	-0.687	.492	0.633	0.17 – 2.33
Special education[2]	-0.58	0.93	-0.630	.529	0.558	0.09 – 3.43
Grade: 6[3]	-3.59	1.29	-2.773	.006	0.028	0.00 – 0.35
Fall 2022 diagnostic score[4]	0.01	0.00	2.802	.005	1.013	1.00 – 1.02
≥ 1 SP/week[5]	**1.91**	**0.70**	**2.737**	**.006**	**6.775**	**1.72 – 26.66**

Note. Dependent variable: 2023 EQAO Assessment of Mathematics proficiency status (0 = did not meet provincial standard, 1 = met or surpassed provincial standard). β = logistic regression coefficient, *SE* β = standard error, OR = odds ratio, CI = confidence interval, SP = skills proficient
[1] Dummy coded; male as reference group
[2] Dummy coded; non-special education students as reference group
[3] Dummy coded; grade 3 as reference group
[4] Grand-mean centered
[5] Dummy coded; FNMI students reaching < 1 IXL Math SP/week as reference group