The Usage Effect of IXL Science in a Massachusetts School District

Executive Summary

IXL is a personalized learning platform designed to help students build academic skills. Previous research has shown that IXL can have significant impact on academic performance at an individual school or district (Empirical Education, 2013). To specifically evaluate the usage effect of IXL Science, researchers studied 248 5th grade students from three public schools in the state of Massachusetts. These students used IXL Science for the first time in the spring semester of the 2018-19 school year. To determine the usage effect of IXL Science, researchers evaluated the impact of five IXL Science usage indicators (i.e., time spent, number of questions answered, number of skills practiced, number of skills proficient, and number of skills mastered) on academic performance on the 2019 Massachusetts Comprehensive Assessment System – Science and Technology/Engineering (MCAS – STE).

Researchers found positive and statistically significant correlations between the five IXL Science usage indicators and 2019 MCAS – STE scores. Using multilevel linear regression models, it was also concluded that the usage effects of IXL Science on assessment performance are statistically significant, after controlling for school baseline performance. Our analysis showed that students performed better on the 2019 MCAS-STE when they: spent more time on IXL Science, answered more questions on IXL Science, practiced more skills, reached proficiency on more skills, and/or mastered more skills on IXL Science. Figure 1 below shows the expected improvement on MCAS – STE raw scores and percentiles resulting from increased IXL Science usage[1].
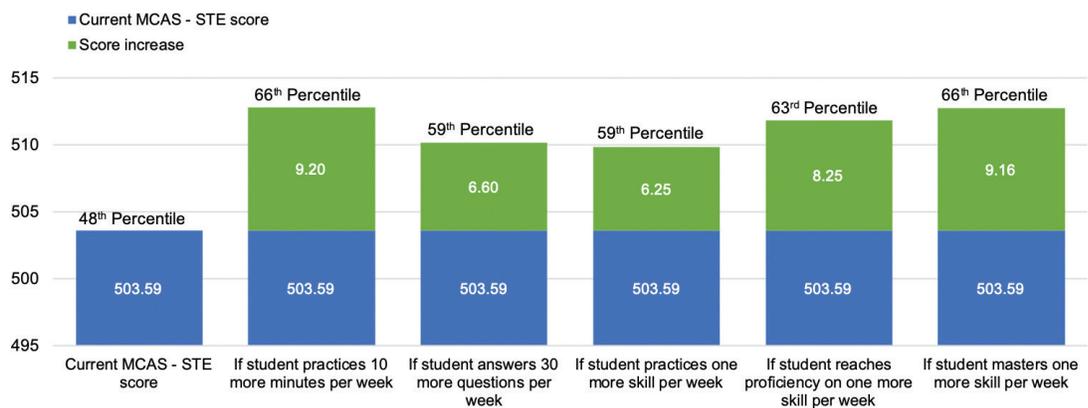

Figure 1. The Usage Effect of IXL Science

[1] *Current MCAS - STE score in the figure indicates the score of an average student from a school with average baseline performance. This student scores better than 48% of all students.*

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Methodology

This study analyzed data on 248 5th grade students from three public schools in the state of Massachusetts who used IXL Science during the 2018-19 spring semester. Two sources of data were used in this study: MCAS-STE performance data and IXL Science usage data.

The district of which the three schools were a part provided 2019 science performance data for the 248 students, as measured by the MCAS – STE. MCAS is Massachusetts's statewide standards-based assessment program developed in 1993 in response to the Massachusetts Education Reform Act. MCAS – STE is the assessment for Science and Technology/Engineering and is administered to students in grades 5 and 10 only. The school-level 2018 science proficiency rates from the 2018 Massachusetts state report card, as measured by the MCAS – STE, were used as the pretest to control for the baseline performance prior to using IXL.[2] Among the 248 5th grade students from three schools (with sample sizes of 138, 29, and 81), the mean score for the 2019 MCAS - STE was 503.84, ranging from 442 to 559 with a standard deviation of 21.14.

Table 1. IXL Science usage

IXL usage (per week)	Mean				SD	Min	Max
	Total	School 1	School 2	School 3			
Time spent (in minutes)	7.76	10.74	4.00	4.02	7.12	.02	38.62
Questions answered	24.05	31.94	10.95	15.31	23.26	.05	141.95
Skills practiced	1.27	1.68	.55	.82	1.13	.05	6.00
Skills proficient	.95	1.29	.46	.56	.98	.00	4.95
Skills mastered	.86	1.15	.41	.52	.89	.00	4.55

IXL Science usage data from the 2018-19 spring semester included the amount of time spent on IXL Science, the number of questions answered, the number of skills practiced, the number of skills proficient, and the number of skills mastered.[3] There was a wide usage range among these 248 students. For example, time spent on IXL Science ranged from .02 to 38.62 minutes per week and the number of skills mastered ranged from .00 to 4.55 per week. See Table 1 for detailed information on the IXL Science usage by these 248 students across the spring semester.

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[2] *Since students take the MCAS-STE for the first time in grade 5, researchers were not able to control for prior performance at the individual level.*

[3] *IXL measures how well a student understands a skill using the SmartScore. This proprietary IXL score ranges from 0 to 100 and is calculated based on a number of metrics, including percentage of questions correct, question difficulty, and consistency. Students have reached proficiency with a SmartScore of 80 and mastery with a SmartScore of 100.*

Research Questions

This study allowed us to answer two research questions:

1. 1. Is there a positive correlation between the 2019 MCAS-STE scores and IXL Science usage? In other words, if a student practiced more on IXL Science, would they be expected to perform better on the 2019 MCAS – STE assessment?

2. Controlling for 2018 school science performance, what did the predictive effects of IXL Science usage on the 2019 science scores look like? To be more specific, with additional IXL Science usage, what changes would be expected in science performance scores?

Analysis Plan

To answer the first research question, the correlation coefficients between the 2019 science scores and the IXL Science usage indicators were calculated. To answer the second research question, a set of multilevel linear regression models were used to determine the IXL Science usage effect. The outcome variable in these regression models was the students' science scores on the 2019 MCAS – STE on model level 1, with a baseline model controlling for schools' prior science performance in 2018 on model level 2. Then the five IXL Science usage indicators were added into the baseline model level 1 separately and exclusively, to avoid multicollinearity issues due to the strong correlations among the indicators (e.g., the students that spent more time on IXL Science also answered more questions on IXL Science).

To assist in the interpretation of the IXL usage effects, we reported statistical significance and effect size in the results section. Statistical significance, also referred to as p-value, is the probability that the IXL effect is zero. A small p-value (e.g., less than 0.05) indicates strong evidence that the IXL effect is not zero. Effect size is reported using the standardized regression coefficient in the present study, with ±.1 for a small effect size, ±.3 for a moderate effect size, and ±.5 for a large effect size. More details about these analytical methods can be found in What Works Clearinghouse (2014).

Results

Positive, statistically significant correlations were found between the 2019 MCES-STE scores and all five IXL Science usage indicators. The correlation coefficients ranged from .27 to .40 with p values < 0.01. These results indicate that more time spent on IXL Science, more questions answered, and more skills practiced, proficient, or mastered were all associated with better performance on the 2019 MCAS – STE assessment. See Table 2 for the correlation matrix for 2019 MCAS-STE scores and IXL Science usage.

Table 2. Correlation matrix

Correlation coefficient	2019 MCAS - STE	Time spent (in minutes)	Questions answered	Skills practiced	Skills proficient	Skills mastered
2019 MCAS - STE	–	.326**	.268**	.338**	.391**	.393**
Time spent (in minutes)		-	.912**	.893**	.890**	.875**
Questions answered			-	.950**	.939**	.929**
Skills practiced				-	.979**	.974**
Skills proficient					-	.996**
Skills mastered						-

*Note. ** Correlation is significant at the 0.01 level.*

To further examine the IXL Science usage effect, a set of multilevel linear regression models were tested. The baseline model had students' 2019 MCAS – STE scores as the outcome, controlling for the pretest (2018 school proficiency rate in MCAS – STE). Then, the five IXL Science usage indicators were added into the baseline model separately and exclusively, resulting in five testing models. Table 3 summarized the results for the five usage indicators.
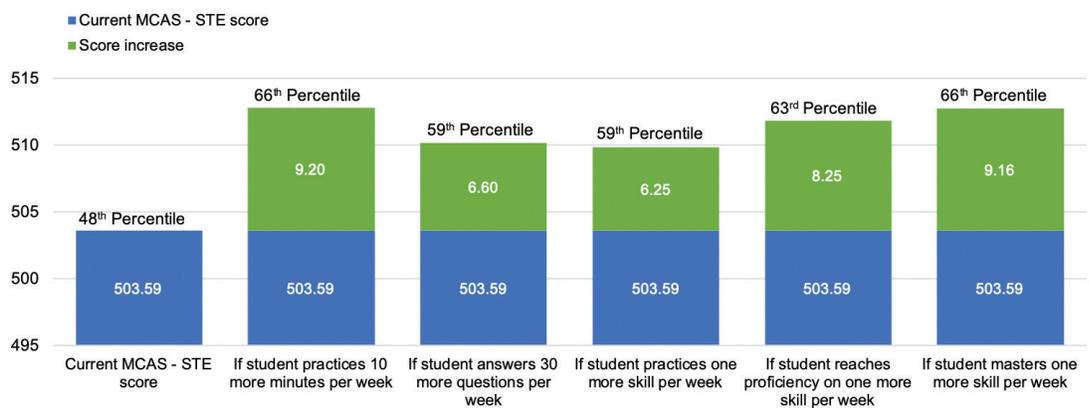
Overall, results showed positive and statistically significant associations between the usage of IXL Science and 2019 MCAS – STE performance. The amount of time spent, number of questions answered, number of skills practiced, number of skills proficient, and number of skills mastered were all significant predictors of the 2019 MCAS – STE scores with p values < .001. The standardized regression coefficients (i.e. beta) ranged from .24 to .39, indicating moderate effect sizes in general.

Table 3. IXL Science usage effects

IXL Science usage (per week)	B	SE	Effect Size	t	*sig.*
Time spent (in minutes)	.92	.18	.31	5.15	<.001
Questions answered	.22	.06	.24	3.75	<.001
Skills practiced	6.25	1.11	.33	5.62	<.001
Skills reached proficiency	8.25	1.25	.38	6.59	<.001
Skills mastered	9.16	1.38	.39	6.65	<.001

The results indicated that the more time a student spends on IXL Science, the more questions he/she answered on IXL Science, and/or the more skills he/she practiced, reached proficiency or mastered on IXL Science, the better he/she performed in the 2019 MCAS – STE assessment.

Specifically, the results suggested that, for an average student, for each additional minute spent on IXL Science per week, their MCAS – STE score would be expected to increase .92 points. For each additional question answered per week, the MCAS – STE score would be expected to increase .22 points. For each additional IXL Science skill practiced per week, the MCAS – STE score would be expected to increase 6.25 points. For each additional IXL Science skill proficient per week, the MCAS – STE score would be expected to increase 8.25 points. For each additional IXL Science skill mastered per week, the MCAS – STE score would be expected to increase 9.16 points. Figure 2 showed the expected improvement in the MCAS – STE raw scores and percentiles resulting from the increased IXL Science usage.

Figure 2. The Usage Effect of IXL Science

[4] *Adjusted percent met or mastered grade level: the percentage of students who received a performance level of "meets or masters grade level" after adjusting for differences in prior performance and school characteristics between IXL schools and non-IXL schools.*

Conclusion

This study found positive and statistically significant correlations between the usage of IXL Science and 2019 MCAS-STE performance. The amount of time spent on IXL Science, number of questions answered, and number of skills practiced, proficient, and mastered were all statistically significant predictors of schools' science performance. These results can be generalized to other similar 5th grade students – the more they practice on IXL Science, the better they will perform on the state science assessment. The analysis also indicates that the usage effect accumulates, so it can be concluded that schools seeking science assessment gains should maximize their usage of IXL Science.

Reference

Empirical Education. (2013). *A Study of Student Achievement, Teacher Perceptions, and IXL Math.* Retrieved from https://www.ixl.com/research/IXL-Research-Study-2013.pdf

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