



RESEARCH REPORT

August 2020

Validation Study of the IXL Real-Time Diagnostic using MAP Growth Assessments

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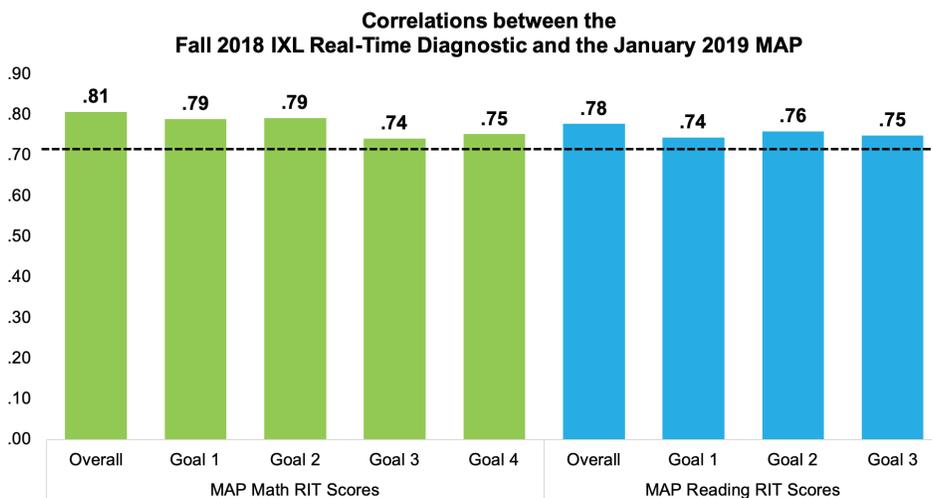
Executive Summary

IXL is a personalized learning platform designed to help students build academic skills. Embedded in IXL, the IXL Real-Time Diagnostic assesses students across concepts in the K-12 curriculum and delivers up-to-the-minute insights on their grade-level proficiency in math and English language arts (ELA). Using these insights, IXL creates personalized action plans that guide every learner to the exact skills that will help him or her grow.

To measure a student’s knowledge levels, the Real-Time Diagnostic applies item response theory (IRT) models to estimate the numeric scores for a set of strands (i.e., a broad category of skills). For math, the strands include (a) Numbers & Operations, (b) Algebra & Algebraic Thinking, (c) Fractions, (d) Geometry, (e) Measurement, and (f) Data, Statistics, & Probability. For ELA, the stands include (a) Vocabulary, (b) Grammar & Mechanics, (c) Reading Strategies, and (d) Writing Strategies. The overall diagnostic scores for math and ELA are weighted averages of the strand scores.

The IXL Real-Time Diagnostic was collaboratively created and reviewed by a group of educators and mathematicians, and covers academic skills aligned to the Common Core and other important standards. As a rigorous assessment, the IXL Real-Time Diagnostic is widely used in schools and classrooms to evaluate student knowledge and track growth. These facts are indicators of the face validity and content validity of the IXL Real-Time Diagnostic.

To examine the criterion validity (specifically, the predictive validity) of the IXL Real-Time Diagnostic, IXL Learning conducted this validation research study using student-level data from a virtual charter school. Studied samples used IXL’s Real-Time Diagnostic during the 2018 fall semester and took Northwest Evaluation Association’s (NWEA) Measures of Academic Progress (MAP) Growth assessments in January 2019. This validation research found strong and positive correlations between the IXL Real-Time Diagnostic and the MAP Growth assessments: an overall correlation of .81 between math assessments and an overall correlation of .78 between reading assessments. Additionally, for both math and reading, students whose IXL Real-Time Diagnostic scores were on or above their grade level were more likely to have corresponding MAP scores equal to or above the MAP norm levels. This study concluded good predictive validity for the IXL Real-Time Diagnostic assessments.



Objectives

This research aims to validate the IXL Real-Time Diagnostic with an external standardized assessment, the Measures of Academic Progress (MAP) Growth math and reading assessments developed by Northwest Evaluation Association (NWEA). With data and analyses conducted at the individual student level, this validation study answers two research questions:

RQ1: What are the associations between the IXL Real-Time Diagnostic math assessment and the external math assessment (i.e., the MAP Growth math assessment)?

RQ2: What are the associations between the IXL Real-Time Diagnostic reading assessment and the external reading assessment (i.e., the MAP Growth reading assessment)?

Study Design and Methodology

To validate the IXL Real-Time Diagnostic with the MAP Growth math and reading assessments, this study obtained the January 2019 MAP Growth data from 12,552 students in a large virtual public charter school in the United States. IXL Real-Time Diagnostic scores during the 2018 fall semester were retrieved from the IXL database. To get a pinpointed diagnostic score for a certain subject in IXL's Real-Time Diagnostic, an IXL user needs to answer a certain amount of questions. As a result, the validation analyses were conducted with data from 208 students who received pinpointed IXL Diagnostic math scores and 458 students who received pinpointed IXL Diagnostic reading scores during fall 2018. Table A1 in Appendix A shows the demographic backgrounds of the study samples which had similar distributions of characteristics among all students, suggesting sample representativeness.

The MAP Growth math and reading assessments are large-scale standardized assessments that have been used as the formative assessments in many school districts to measure what students know and inform what they are ready to learn next (<https://www.nwea.org/map-growth/>). They are a collection of computer-based adaptive assessments administered to students in grades pre-K to 12. Students below 2nd grade take the MAP Growth K-2, students in 2nd through 5th grade take the MAP Growth 2-5, and students at or above 6th grade take the MAP Growth 6+.

MAP Growth uses the RIT score, which is a Rasch Unit scale score developed under the item response theory (IRT) to interpret student performance in the assessment, regardless of age or grade level. RIT scores are ideal for this current study because "RIT scores are on an equal interval scale that is not grade specific, it can show growth from one year to the next," according to the MAP data use guide (<https://accountability.madison.k12.wi.us/datauseguides>). The RIT scale scores typically range between 150 and 300. The higher the RIT score, the higher the achievement the student has shown in the subject. In MAP math and reading tests, RIT scores are also reported in different goal areas to show students' relative strengths and areas of concern.

Table 1, obtained from the NWEA website, shows the MAP goal areas in math and reading. This study used the MAP overall math RIT scores and RIT scores in four goal areas in math, as well as MAP overall reading RIT scores and RIT scores in three reading goal areas that are shared for all grades¹.

Table 1. MAP test goal areas (copied from the NWEA website)

Test name	Goal area	Math	Reading
MAP Growth K-2	Goal 1	Number Sense	Reading Foundations
	Goal 2	Algebraic Reasoning and Algebra	Comprehension, Critical Reading, and Research
	Goal 3	Geometry and Measurement	Vocabulary
	Goal 4	Data and Probability	Writing and Language
MAP Growth 2-5, MAP Growth 6+	Goal 1	Number and Operations	Reading Process: Read and Comprehend Texts
	Goal 2	Algebraic Reasoning and Algebra	Critical Reading: Interpret and Evaluate Texts
	Goal 3	Geometry and Measurement	Vocabulary
	Goal 4	Data and Probability	N/A

Students’ MAP scores for math and reading were compared to the corresponding 2015 MAP RIT Scale Norms for mid-year tests (<https://files.eric.ed.gov/fulltext/ED568352.pdf>). The norms represent the average score of U.S. students in the same grade who took the MAP assessment for a certain subject. Whether a student was below or equal/above the norm of his or her grade level on a subject was used as an indicator in the study analyses.

¹ Since MAP reading Goal 4 is only applicable for K-2 students, the sample size was not large enough to test the validity.

Analysis

Researchers performed Pearson correlation analyses to evaluate the relationship between IXL Real-Time Diagnostic math/reading scores and MAP Growth math/reading assessment scores. Pearson's correlation coefficient (r) is a measure of the linear relationship between two variables, ranging from -1.00 to +1.00. An r value of 0 indicates no correlation while r values above +.70 are considered strong and positive (Ratner, 2009). Higher correlations between IXL Real-Time Diagnostic math/reading scores and corresponding MAP Growth math/reading assessment scores indicate good validity of the IXL Real-Time Diagnostic in measuring student academic achievement.

This study also computed chi-square statistics and odds ratio statistics using logistic regressions. For math and reading separately, researchers examined whether students whose IXL Real-Time Diagnostic scores are on or above their grade level are more likely to have MAP scores that are equal or above the norm levels.

Tests of statistical significance were examined and p values are reported for all the statistical tests in the study. A p value less than .05 indicates statistical significance—evidence that the associations between IXL Real-Time Diagnostic scores and MAP Growth assessment scores are not zero.

Results

This validation research found positive and strong associations between the IXL Real-Time Diagnostic and the MAP Growth assessments with correlations ranging from .74 to .81 for math assessments and ranging from .74 to .78 for reading assessments. Additionally, for both math and reading, students whose IXL Real-Time Diagnostic scores were on or above their grade level were significantly more likely to have MAP scores that were equal or above the MAP norm levels. In sum, the IXL Real-Time Diagnostic assessments showed good predictive validity.

Validating the IXL Real-Time Diagnostic Math Assessment

The IXL Real-Time Diagnostic math assessment was found to have positive and strong correlations with the MAP Growth math assessments. The correlation between IXL Diagnostic scores and MAP Growth math overall scores was .81 with $p < .01$ (see Figure 1). The correlations between IXL Diagnostic scores and scores for MAP Growth's four math goals were .79, .79, .74, and .75 respectively, with p values $< .01$ (see Table B1 in Appendix B).

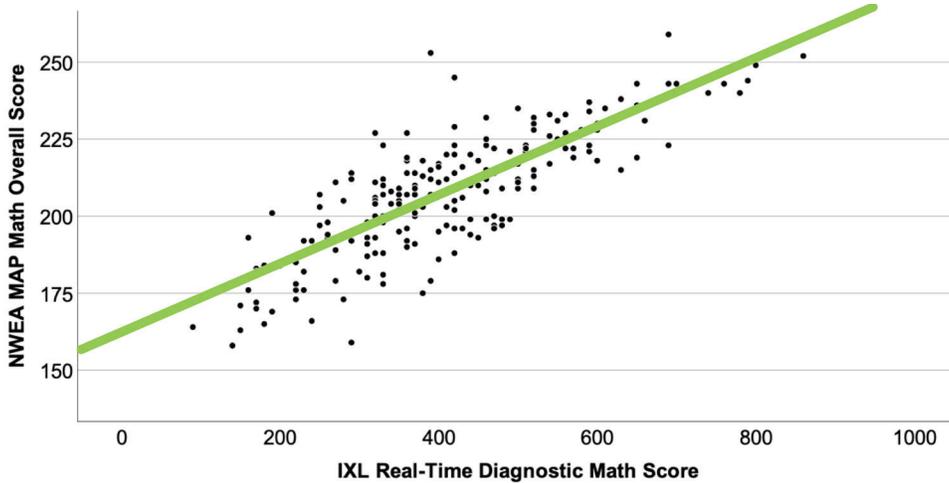


Figure 1. The scatterplot showing the correlation between IXL Real-Time Diagnostic math scores and MAP Growth overall math scores

Additionally, it was found that students whose IXL Real-Time Diagnostic math scores were on or above their grade level were more likely to have MAP math scores that were equal or above the norm levels ($\chi^2 = 42.43, p < .001$). Among students whose IXL Real-Time Diagnostic math scores were on or above their grade level, 77% of them had MAP math scores that were equal or above the norm levels; whereas for students whose IXL Real-Time Diagnostic math scores were below their grade levels, only 27% of them had MAP math scores that were equal or above the norm levels (see Figure 2 below and Table B2 in Appendix B). Logistic regression showed that students whose IXL Real-Time Diagnostic math scores were on or above their grade levels were 9.42 times more likely to reach MAP norm levels than students whose IXL Real-Time Diagnostic math scores were below their grade levels (see Table B2 in Appendix B for details).

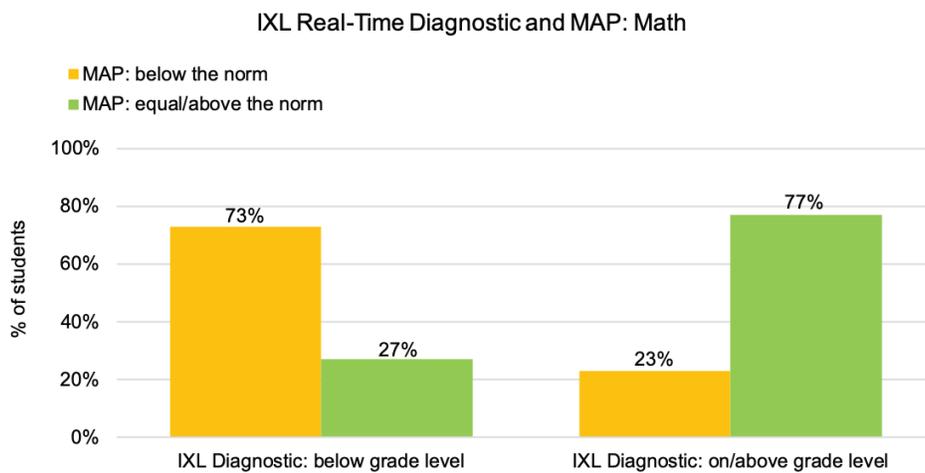


Figure 2. The relationship between IXL Real-Time Diagnostic math scores (on or above vs. below grade level) and the MAP Growth math assessment scores (equal or above vs. below the norm)

Validating the IXL Real-Time Diagnostic Reading Assessment

The IXL Real-Time Diagnostic reading assessment was found to have positive and strong correlations with the MAP Growth reading assessments. The correlation between IXL Diagnostic scores and the MAP Growth reading overall scores was .78 with $p < .01$ (See Figure 3). The correlations between IXL Diagnostic scores and scores for MAP Growth’s three reading goals were: .74, .76, and .75 respectively, with p values $< .01$ (see Table B3 in Appendix B).

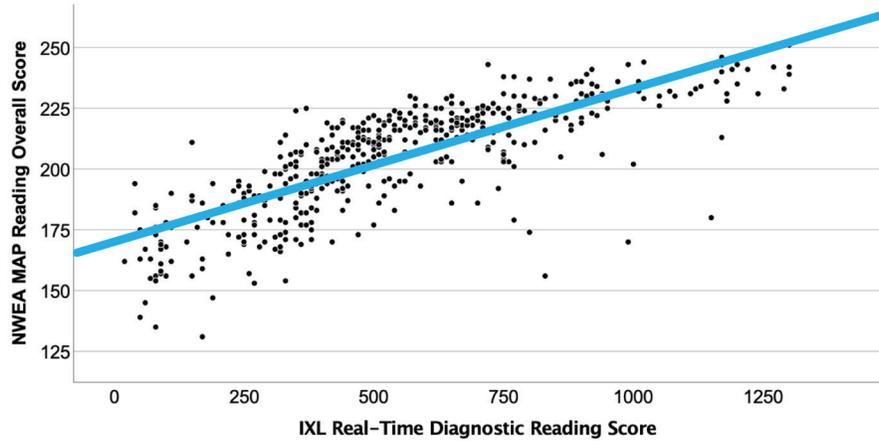


Figure 3. The scatterplot showing the correlation between IXL Real-Time Diagnostic reading scores and MAP Growth overall reading scores

Additionally, it was found that students whose IXL Real-Time Diagnostic reading scores were on or above their grade level were more likely to have MAP reading scores that were equal or above the norm levels ($\chi^2 = 115.18, p < .001$). Among students whose IXL Real-Time Diagnostic reading scores were on or above their grade level, 77% of them had MAP reading scores that were equal or above the norm levels; whereas for students whose IXL Real-Time Diagnostic reading scores were below their grade level, only 27% of them had MAP reading scores that were equal or above the norm levels (see Figure 4 below and Table B4 in Appendix B). Logistic regression showed that students whose IXL Real-Time Diagnostic reading scores were on or above their grade level were 9.43 times more likely to reach MAP norm levels than students whose IXL Real-Time Diagnostic reading scores were below their grade levels (see Table B4 in Appendix B for details).

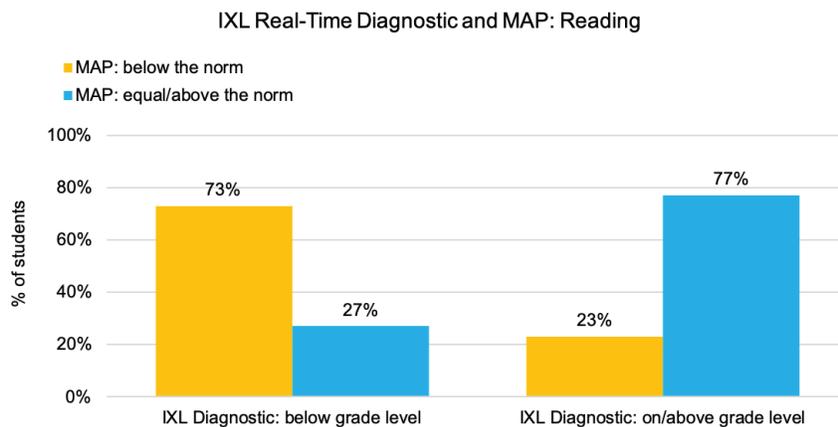


Figure 4. The relationship between IXL Real-Time Diagnostic reading scores (on or above vs. below grade level) and the MAP Growth reading assessment scores (equal or above vs. below the norm)

Conclusion

Despite having relatively small samples², this validation study found positive and strong associations between the IXL Real-Time Diagnostic and the MAP Growth assessments for both math and reading. Both the IXL Real-Time Diagnostic math and reading assessments were shown to have good predictive validity, and can be used as valid assessments to measure student learning outcomes.

Reference

Ratner, B. (2009). The correlation coefficient: Its values range between +1/-1, or do they? *Journal of Targeting, Measurement Analysis for Marketing*, 17, 139-142. <https://doi.org/10.1057/jt.2009.5>

² IXL Learning will continue to conduct validation studies using more samples with different kinds of external standardized assessments.

Appendix A. Demographic Background

Table A1. Demographic background information for IXL students and all students

	All students with MAP math or reading scores	Students with IXL math diagnostic scores and MAP math scores	Students with IXL reading diagnostic scores and MAP reading scores
Number of students	12,552	208	458
Gender			
Male	6,350 (51%)	106 (51%)	244 (53%)
Female	6,196 (49%)	102 (49%)	214 (47%)
Status			
Econ. disadvantaged	7,076 (56%)	121 (58%)	279 (61%)
Special education	2,404 (19%)	57 (27%)	116 (25%)
English language learners	117 (1%)	5 (2%)	3 (1%)
Race/Ethnicity			
White	8,171 (65%)	138 (66%)	297 (65%)
American Indian	1,789 (14%)	29 (14%)	75 (16%)
African American	1,151 (9%)	12 (6%)	35 (8%)
Hispanic or Latino	1,272 (10%)	24 (12%)	47 (10%)
Asian	110 (1%)	5 (2%)	4 (1%)
Grade levels			
Pre-K and K	1,702 (16%)	3 (2%)	19 (4%)
Grade 1	962 (8%)	6 (3%)	17 (4%)
Grade 2	1,066 (8%)	14 (7%)	36 (8%)
Grade 3	1,189 (9%)	29 (14%)	56 (12%)
Grade 4	1,150 (9%)	25 (12%)	53 (12%)
Grade 5	1,231 (10%)	28 (14%)	57 (12%)
Grade 6	1,473 (12%)	37 (18%)	65 (14%)
Grade 7	1,739 (14%)	33 (16%)	72 (16%)
Grade 8	1,763 (14%)	28 (14%)	69 (15%)
Grade 9 and up	271 (2%)	5 (2%)	14 (3%)

Appendix B. Analyses Results

Table B1. Correlation analysis for math

Correlations with IXL Diagnostic (math)	<i>r</i>	95% CI
MAP Math overall	.81**	[.76, .85]
MAP Math Goal 1	.79**	[.73, .84]
MAP Math Goal 2	.79**	[.73, .84]
MAP Math Goal 3	.74**	[.67, .80]
MAP Math Goal 4	.75**	[.68, .80]

Note: ** $p < .01$; $n = 208$

Table B2. Chi-square test and logistic regression for math

		MAP Math		χ^2	Odds ratio
		Below the norm	Equal/above the norm		
IXL Real-Time Diagnostic (Math)	Below the grade level	113 (73%)	41 (27%)	42.43***	9.42***
	On/above grade level	12 (23%)	41 (77%)		

Note: *** $p < .001$; $n = 207$ (excluded one case in pre-kindergarten without MAP norm)

Table B3. Correlation analysis for reading

Correlations with IXL Diagnostic (reading)	<i>r</i>	95% CI
MAP Reading overall	.78**	[.74, .81]
MAP Reading Goal 1	.74**	[.70, .78]
MAP Reading Goal 2	.76**	[.72, .80]
MAP Reading Goal 3	.75**	[.71, .79]

Note: ** $p < .01$; $n = 458$

Table B4. Chi-square test and logistic regression for reading

		MAP Reading		χ^2	Odds ratio
		Below the norm	Equal/above the norm		
IXL Real-Time Diagnostic (reading)	Below the grade level	138 (73%)	50 (27%)	115.18***	9.43***
	On/above grade level	60 (23%)	205 (77%)		

Note: *** $p < .001$; $n = 453$ (excluded four cases in pre-kindergarten and one case in 12th grade without MAP norm)