RESEARCH REPORT

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Predictive Validity of the IXL Real-Time Diagnostic Using the Ontario EQAO Assessment of Mathematics as Criterion

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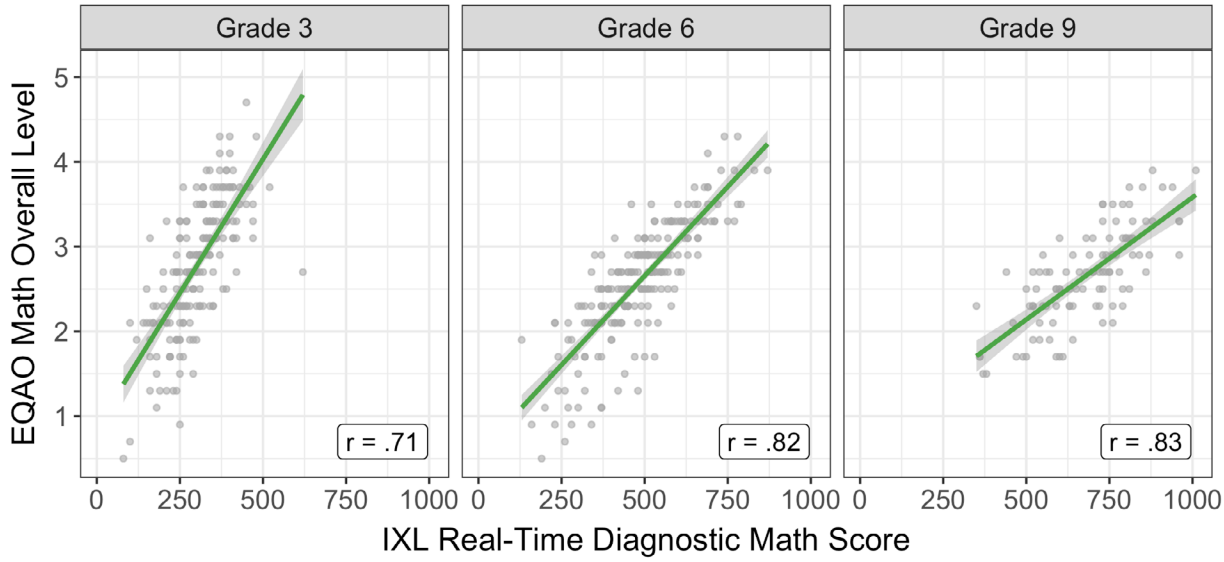
Executive Summary

IXL is an end-to-end teaching and learning solution that engages Canadian learners in grades K through 12 with a comprehensive curriculum and a first-of-its-kind assessment suite. A core component of IXL's assessment suite is the IXL Real-Time Diagnostic, an interim assessment designed to provide students and educators with in-the-moment information about students' subject area knowledge. The diagnostic was designed by a team of educators and subject matter experts and uses item response theory to automatically adjust question difficulty based on students' response patterns. The diagnostic provides immediate insights about students' current knowledge levels and, using these results, creates personalized action plans that help students close gaps quickly.

IXL's Real-Time Diagnostic has been validated with other standardized assessments including the NWEA MAP Growth, Star, FSA, PSSA, NC EOG, NJSLA, SOL, MCAS, ILEARN, SC Ready, and WVGSA assessments (An, 2021, 2022a, 2022b, 2022c; Hargis, 2022, 2023; IXL Learning, 2020b, 2020a; Schonberg, 2021a, 2022, 2023a, 2023b). The goal of this study was to assess the validity of IXL's Real-Time Diagnostic in math using a new criterion measure: the Ontario Education Quality and Accountability Office (EQAO) Assessment of Mathematics. We analyzed data from students in grades 3, 6, and 9 from one Ontario district school board and found:

- Strong, positive correlations between IXL Diagnostic and EQAO Math Assessment performance (all *r*s > .70)

- A high degree of overlap in student proficiency classifications by the IXL Diagnostic and EQAO Math Assessments



These results provide further evidence that IXL's Real-Time Diagnostic is a valid measure of student grade-level proficiency.

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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 has consistently reported significant, positive effects of IXL on student learning, including in an independent randomized control trial conducted by Johns Hopkins University (Copeland et al., 2023).

A core component of IXL's assessment suite is the IXL Real-Time Diagnostic, an interim assessment designed to provide students and educators with in-the-moment information about students' subject area knowledge. The diagnostic was designed by a team of educators and subject matter experts and uses item response theory to automatically adjust question difficulty based on students' response patterns. The diagnostic provides immediate insights about students' current knowledge levels and, using these results, creates personalized action plans that help students close gaps quickly.

Many studies have examined the psychometric properties of the IXL Real-Time Diagnostic and found robust reliability and validity evidence, including coherent internal structure (IXL Learning, 2020a), high reliability (IXL Learning, 2020a; Schonberg, 2021b), multi-group measurement invariance (An, Xiong, & Bashkov, 2022), and strong predictive validity coefficients using multiple well-established assessments as criterion measures (for details, see IXL's assessment research page). In sum, there is ample evidence that the IXL Real-Time Diagnostic can provide educators with accurate information about student knowledge levels in math and English throughout the year that can be used to track growth and assess students' readiness for end-of-year exams.

The goal of this study was to validate IXL's Real-Time Diagnostic using a new criterion measure: the Ontario Education Quality and Accountability Office (EQAO) Assessment of Mathematics. Specifically, we aimed to answer the following research questions:

1. How strong are the correlations between students' scores on the IXL Real-Time Diagnostic math assessment and their level on the EQAO Assessment of Mathematics?

2. What is the degree of overlap in student grade-level proficiency classifications by IXL's Real-Time Diagnostic and the EQAO Assessment of Mathematics? That is, to what extent do students receive the same classifications (on or above grade level vs. below) by IXL's Diagnostic and EQAO?

Study Design and Methodology

DATA SOURCES

EQAO Assessment Data

To validate the IXL Real-Time Diagnostic with the EQAO Assessment of Mathematics, we obtained Spring 2023 student-level assessment performance data from an English Catholic district school board in Ontario. 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). For more information about the EQAO assessments, see the EQAO assessments homepage.

IXL Diagnostic Data

IXL Real-Time Diagnostic data were 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 650 indicates that the student has acquired about 50% of grade six material, whereas a score of 700 indicates that the student is ready to learn grade seven material. We obtained all available pinpointed math diagnostic scores from students in this district school board during the 2022-23 school year and used those closest to the EQAO Assessment of Mathematics administration dates in the analysis.

PARTICIPANTS

To be included in the analytic sample, students needed to have both a 2023 EQAO Math level and a pinpointed IXL Real-Time Diagnostic score in math from no more than 90 days before the EQAO assessment was administered. Using these criteria, we obtained a sample of 453 students. Overall, the student sample was 54.3% male, 7.5% English language learners (i.e., did not learn English as a first language at home), and 26.9% receiving special education services. In addition, 19.4% of the sample identified as First Nation, Métis, or Inuit. Descriptive statistics for students' diagnostic scores and EQAO levels are presented in Table A1 (Appendix).

ANALYTIC APPROACH

Research Question 1: Correlations Between IXL Real-Time Diagnostic and EQAO Performance

To examine the relationship between scores on IXL's Real-Time Diagnostic and levels on the EQAO Assessment of Mathematics, we used correlations (Pearson's *r*) to assess test-criterion relations within each grade separately. Correlation values can range from -1.00 to +1.00 and indicate the strength of a linear relationship between two variables; values above .70 are considered to indicate a strong, positive relationship (Ratner, 2009). Thus, *r* coefficients above .70 between students' IXL Real-Time Diagnostic scores and their EQAO math assessment levels would provide additional predictive validity evidence for the IXL Real-Time Diagnostic as a measure of grade-level proficiency using the EQAO math assessment as criterion.

Research Question 2: Alignment of Student Proficiency Classifications Across Measures

In addition to correlations between IXL Real-Time Diagnostic scores and EQAO math assessment levels, we also examined alignment of student proficiency classifications across the two measures. Specifically, we conducted chi-square tests to investigate the degree to which students who performed on or above grade level on the IXL Real-Time Diagnostic also performed at or above Level 3 (i.e., meeting or exceeding the provincial standard) on the EQAO math assessment (or, conversely, whether students' performance was below grade level on both measures). In addition, we conducted logistic regressions using IXL diagnostic proficiency status (i.e., an IXL Real-Time Diagnostic score on or above grade level) to predict the likelihood of achieving proficiency (i.e., reaching Level 3 or higher) on the EQAO math assessment.

Results

We found strong, statistically significant correlations between IXL Real-Time Diagnostic math score and EQAO Assessment of Mathematics level in each grade (all *p*s < .001). See Figure 1 for scatterplots of these correlations by grade.

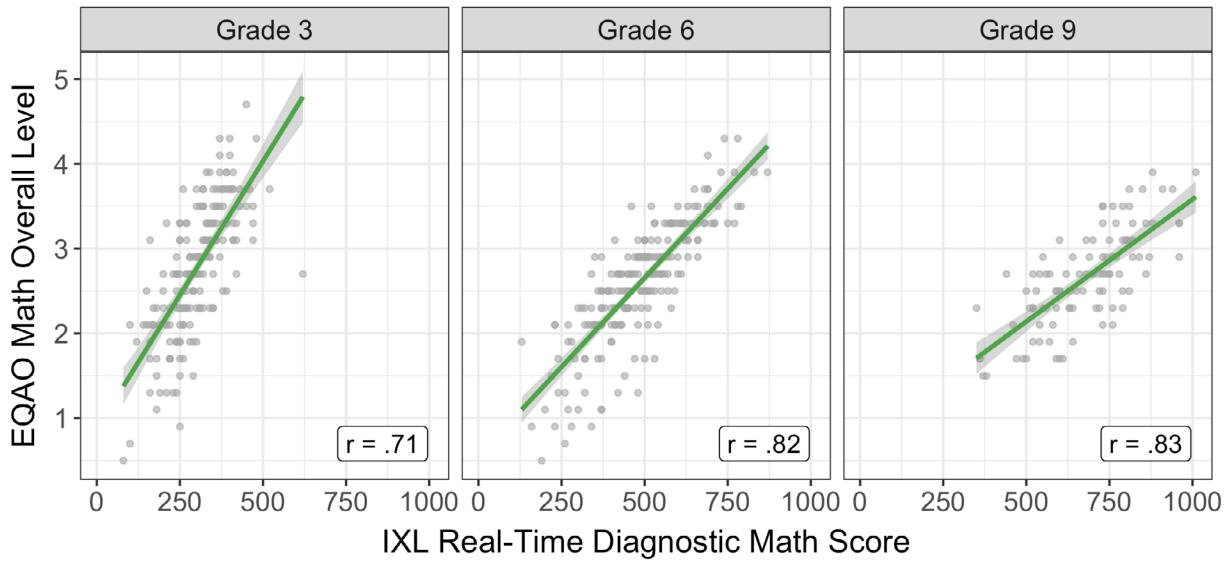


Figure 1. Correlations between IXL Real-Time Diagnostic score and EQAO level. All correlations are statistically significant at p < .001.

Next, we examined the alignment of student proficiency classifications across the two measures. We found that IXL's Real-Time Diagnostic in math and the EQAO in math aligned in how they classified the majority of students, $\chi^2(1) = 147.49$, $p < .001$. Specifically, the overall classification alignment was 81% (AUC = .73, 95% CI [.691 - .770]). That is, 81% of students were classified by both measures as performing on or above grade level, or by both measures as performing below grade level. In line with this finding, a logistic regression model predicting EQAO math proficiency status from IXL math diagnostic proficiency status showed that students who were classified as proficient by the IXL Real-Time Diagnostic were more than 20 times more likely to be proficient (i.e., Level 3 or higher) on the EQAO math assessment than students who were not proficient on IXL's Diagnostic (see Table A2, Appendix).

Conclusion

In this study, we investigated the predictive validity of the IXL Real-Time Diagnostic using a new assessment as criterion: the EQAO Assessment of Mathematics. We examined test-criterion relationships between IXL's Diagnostic and the EQAO assessment and found strong correlations between the diagnostic measure and the provincial assessment. In addition, we found a high degree of alignment in the EQAO assessment and Real-Time Diagnostic classifications of students into proficiency levels (on or above vs. below grade level). Coupled with prior examinations of content validity (Bashkov et al., 2021), construct validity (IXL Learning, 2020a), and predictive validity (An, 2022c; IXL Learning, 2020b; Schonberg, 2021a), these findings corroborate a strong program of validity for the IXL Real-Time Diagnostic. As such, we encourage teachers and school leaders in Ontario to use IXL and its diagnostic with their students to boost learning and monitor progress before the EQAO assessments.

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Appendix: Descriptive Statistics and Analysis Results

Table A1. Means (Standard Deviations) for Math Assessments

	n	IXL Real-Time Diagnostic math score	EQAO math overall level
Grade 3	173	307.51 (84.57)	2.81 (0.78)
Grade 6	213	485.26 (136.77)	2.60 (0.70)
Grade 9	67	690.15 (167.66)	2.76 (0.64)

Table A2. 2x2 Table, Chi-Square, and Logistic Regression

		EQAO Math		χ^2	Odds ratio
		Not proficient	Proficient		
IXL Real-Time Diagnostic Math	Below grade level	287 (97%)	10 (3%)	147.49***	30.21***
	On or above grade level	76 (49%)	80 (51%)		

Note. *** $p < .001$.