Istation

Using Istation Math to Improve Student Outcomes on the NWEA MAP Math Assessment

PREPARED BY
Matthew Jeans, PhD

DATE
January 2024

Executive Summary

Istation is an integrated learning system that provides assessments, supplemental curriculum, and detailed reports that can be used for progress monitoring or benchmarking. It provides a computer adaptive test for universal screening, and students are routed into the curriculum based on assessment performance.

Istation recommends that students use the supplemental curriculum 30–40 minutes per week to increase their performance in math. Previous research with the Istation Math curriculum demonstrated that Istation usage increased math performance (Patarapichayatham et al., 2021). This research evaluates if using the Istation Math curriculum leads to academic growth on the NWEA MAP Math assessment.

Using data from a Texas school district in the 2022–23 school year, linear regression and hierarchical linear models accounting for clustering at the school level were used. Usage was divided into quintiles, with quintile 1 indicating the lowest amount of usage and quintile 5 indicating the highest amount of usage. Results indicated that Istation curriculum usage led to NWEA MAP Math growth in all grades:

- Kindergarten students in usage quintiles 3 and 5 had gain scores 2–5 points higher on NWEA MAP Math than those in lower usage quintiles.
- First Grade students in usage quintiles 2–5 had gain scores that were 2–5 points higher on NWEA MAP Math than those in the usage quintile 1.
- Second grade students in usage quintiles 3 and 5 had gain scores 2–3 points higher on NWEA MAP Math than those in lower usage quintiles.
- Third grade students in usage quintiles 2–5 had gain scores 2–5 points higher on NWEA MAP Math than those in usage quintile 1.
- Fourth grade students in usage quintile 5 had gain scores 2 points higher on NWEA MAP Math than those in lower usage quintiles.

8150 N. Central Expressway, Suite 2000 Dallas, TX 75206 | 866-883-7323 | proposals@istation.com

These results demonstrate that using Istation helps student performance in math as measured by the NWEA MAP Math assessment. Furthermore, greater NWEA MAP Math growth was observed in students with higher Istation Math usage, suggesting that meeting the supplemental curriculum usage recommendations can increase Math achievement as measured by the NWEA MAP Math growth assessment.

Table of Contents

Introduction

In the evolving landscape of mathematics education, digital learning platforms have emerged as pivotal tools for enhancing student performance. The onset of the COVID-19 pandemic has significantly accelerated this trend, reshaping traditional methodologies and fostering new, technology-driven approaches to mathematics learning. The pandemic had a notable negative impact on student performance in mathematics, and recovery to pre-pandemic levels is likely years away (Patarapichayatham & Locke, 2023). However, a study by Marbán et al. (2021) highlights how digital learning, especially through digital and social media platforms, has been instrumental in modeling classroom interactions and improving attitudes and skills toward mathematics learning among primary and secondary students. This shift towards digital platforms has supported marked improvement in students' performance in discrete mathematics through the targeted use of specialized digital tools to enhance mathematical understanding and achievement (Susaie et al., 2022).

The transition to digital learning in mathematics is a stopgap measure and a potential permanent transformation in educational practice (Mulenga & Marbán, 2020). Their study posits COVID-19 as a catalyst for a broader adoption of digital learning methodologies in mathematics education. Complementing these findings, gamification can significantly boost student motivation and performance in mathematics courses (Parody et al., 2022). These studies underscore the transformative impact of digital learning platforms in mathematics education, paving the way for a more interactive, engaging, and effective learning experience.

Istation Math is a comprehensive, computer-adaptive testing system focusing on continuous progress monitoring in mathematics (Ketterlin-Geller, 2021). The assessment covers grades prekindergarten through 8th grade, and the curriculum is designed for students up to 5th grade. The first time the student takes the assessment in the school year, their results are used to place them in the curriculum. This user-friendly platform offers engaging, age-appropriate interfaces and real-time data for

teachers, aiding in identifying students struggling with mathematical concepts and tailoring instruction accordingly. Istation Math covers key mathematical domains such as number sense, operations, algebra, geometry, measurement, data analysis, and personal financial literacy. By providing detailed web-based reports, automatic alerts for students needing additional instruction, and access to a wide range of intervention materials, Istation Math effectively supports personalized learning and instructional decision-making, ensuring students progress toward achieving grade-level standards in math.

Previous research has shown the Istation Math Formative Assessment to be correlated with the Ohio AIR and the ACT Aspire (Patarapichayatham & Locke, 2020a; Patarapichayatham & Locke, 2020b). Recent research also demonstrates a strong correlation with the NWEA MAP Math assessment, allowing educators to project student performance on the NWEA MAP Math assessment based on Istation Math performance (Jeans, M., 2024). In addition, research on the Istation Math curriculum demonstrated that Istation usage increased performance on the Istation Math Formative Assessment in kindergarten through third grade students (Patarapichayatham et al., 2021). The results were more pronounced in the lower grades, with students in kindergarten and first grade having significantly greater gains than their counterparts in second and third grades. However, efficacy research on the Istation Math curriculum and standardized math assessments is limited.

Therefore, this study aims to evaluate the impact of Istation usage on NWEA MAP Math outcomes of kindergarten through fourth grade students in a large urban Texas school district. Specifically, the study aims to address the following question:

- Does the usage of Istation improve student scores on the NWEA MAP Math assessment?

Methodology

Analytical Sample

The data are from students in a large urban school district in Texas. This study focused on kindergarten through fourth grade students (n=3,459). Of those that had demographic data (n=2,027), the largest racial/ethnic group was White (35.8%), followed by Hispanic (30.6%), Black/African American (13.7%), Asian (10.8%), two or more races (8.9%), and American Indian/Alaska Native (< 1%).

Measures

NWEA MAP Math

The NWEA MAP Math assessment is a computer-adaptive test designed to measure student achievement in mathematics from kindergarten through grade 12. It aligns with the Common Core State Standards (CCSS) and is structured to adapt to each student's learning level. The MAP Math scores are reported on the Rasch Unit (RIT) scale, which ranges from 100 to 350, providing a standardized measure of student progress and proficiency. The assessment is administered in three benchmarking periods: fall (beginning of the year, BOY), winter (middle of the year, MOY), and spring (end of the year, EOY). This study specifically examines the impact of Istation Math on kindergarten through fourth grade students, with these MAP Math assessment scores as the primary outcome to measure the effectiveness of the curriculum.

Istation Math

Istation Math is a computer-adaptive testing system designed for continuous progress monitoring in mathematics for students from prekindergarten through 8th grade. It offers a user-friendly experience for both teachers and students, with minimal administrative effort required from educators and engaging, developmentally appropriate interfaces for learners.

For younger students in prekindergarten to first grade, Istation Math employs interactive settings like "Mario's Market" to captivate and assist in identifying students who need additional support in mathematical concepts. In contrast, for students in grades 2 to 8, the assessment adopts a more traditional format with question stems and multiple-choice answers, effectively linked to various teaching resources and targeted intervention strategies.

The Istation Math Formative Assessment comprehensively covers essential mathematical domains, including number sense, operations, algebra, geometry, measurement, data analysis, and personal financial literacy, aligning with the National Council of Teachers of Mathematics (NCTM) standards. The assessment's computer-adaptive nature, powered by Item Response Theory (IRT), tailors the difficulty of questions based on each student's performance, ensuring a highly personalized assessment experience. This approach enhances the accuracy of measuring student abilities and provides real-time, easily interpretable web-based reports. These reports detail students' strengths and weaknesses, enabling teachers to make informed decisions for targeted instruction and intervention.

Additionally, Istation Math includes reporting features that automatically alert teachers to students requiring additional instructional support and offers access to a comprehensive library of instructional materials and lessons. This feature aids in customizing teaching strategies to meet individual student needs, which allows for a more accurate profile of each student's abilities while facilitating enhanced teacher planning and student learning outcomes.

Curriculum Usage

Istation recommends that students at or below the 40th percentile of the normative sample on Istation Math use the curriculum for 40 minutes per week and that students who score above the 40th percentile use the curriculum for 30 minutes per week. For this study, usage quintiles were calculated by grade based on Istation Math

usage within the sample. Quintile 1 represents the lowest amount of usage, and quintile 5 represents the highest usage.

Analytical Approach

Due to the sample having students nested in schools, a hierarchical linear model (HLM) was used to examine the efficacy of Istation curriculum usage on NWEA MAP Math assessment gain scores, which were calculated as the difference between beginning-of-year (BOY) and end-of-year (EOY) scores. However, the intraclass correlations for kindergarten through third grade models were low, suggesting there was little variance in NWEA MAP Math scores attributed to the school level. Therefore, linear regression models were employed for those grades.

HLM was conducted on fourth grade students' data. Two nested models were tested. Model 1 is the baseline model that consists of only the random effect for the intercept. Model 2 is an extension of model 1 that includes fixed effects at Level 1, which includes BOY score and usage quintiles. All models controlled for BOY NWEA MAP Math scores.

Results

Table 1 shows the correlations between Istation Math Formative Assessment and NWEA MAP Math scores at MOY and EOY by grade to determine if there was a significant relationship. Correlation coefficients ranged from 0.83 in kindergarten to 0.88 in first grade, indicating a strong relationship between Istation Math Formative Assessment and NWEA MAP Math.

Table 1. *Istation Math Usage Quintiles and Total Time across School Year by Grade*

Grade	Istation Math MOY & NWEA MAP Winter	Istation Math EOY & NWEA MAP Spring
K	0.84*	0.83*
1	0.88*	0.88*
2	0.87*	0.86*
3	0.86*	0.87*
4	0.85*	0.87*

* $p < 0.05$

Table 2 shows the total minutes by quintiles and grades. Generally, first through third grades had higher usage than kindergarten and fourth grade.

Table 2. *Usage Quintiles and Total Time (Minutes) across School Year by Grade*

Usage Quintile	Usage Percentile Rank	Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade
1	≤20	≤443	≤647	≤722	≤667	≤536
2	21–40	444–670	648–956	723–955	668–942	537–808
3	41–60	671–943	957–1260	956–1214	943–1243	809–1031
4	61–80	944–1276	1261–1614	1215–1636	1244–1661	1032–1364
5	>80	>1277	>1614	>1636	>1661	>1364

Istation Usage on NWEA MAP Outcomes

Figures 1 and 2 show the graphical representation of increases in NWEA MAP Math gain scores by total minutes of usage per school year for grades K through 2 and 3 through 4, respectively.

Figure 1. *Differences in NWEA MAP Math Gain Scores for Kindergarten through Second Grade by Istation Total Usage*

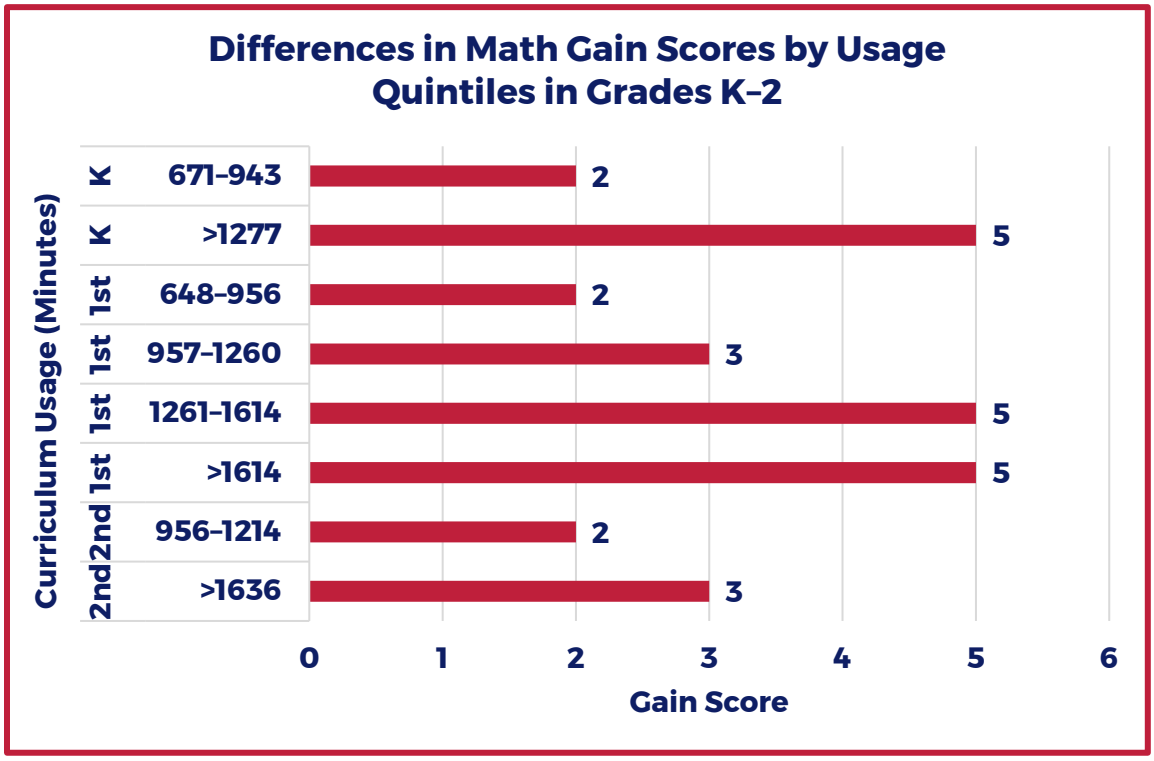
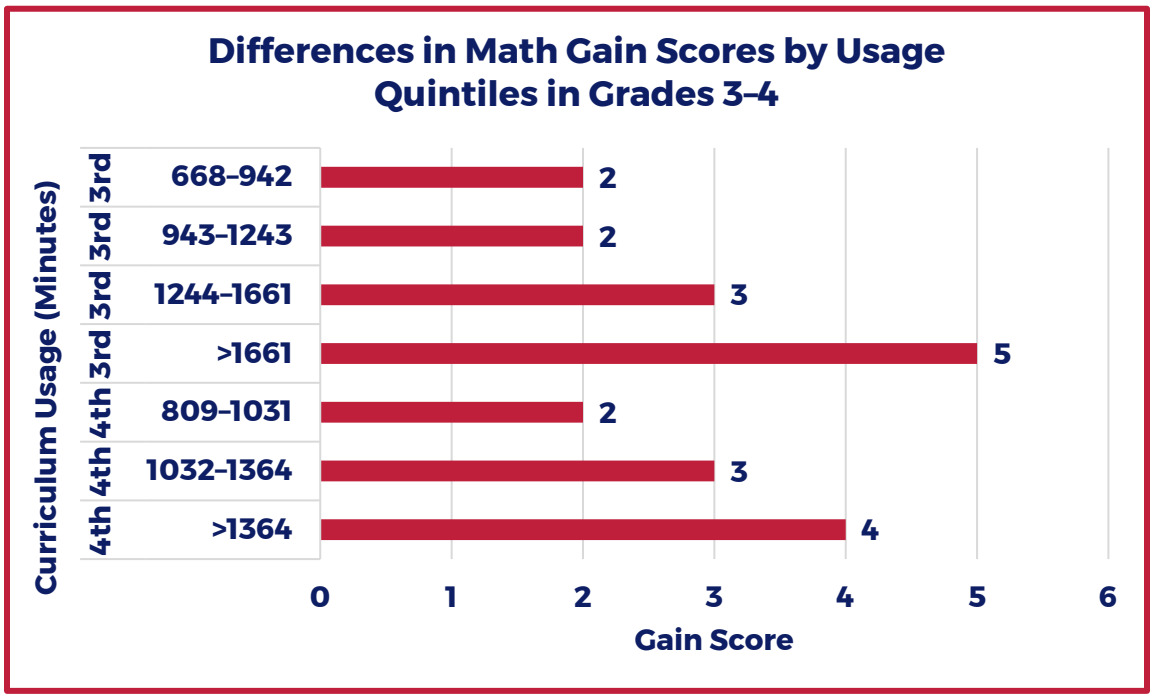


Figure 2. *Differences in NWEA MAP Math Gain Scores for Third through Fourth Grade by Istation Total Usage*



Kindergarten Through Third Grade

Table 3 shows the results of the regression models for kindergarten through third grade students.

Kindergarten students in the third Istation Math usage quintile (671–943 total minutes/school year) had an increase of 2 points in NWEA MAP Math scores compared to students in the lowest usage quintile, the referent group. Those in the fifth usage quintile (>1277 minutes/school year) had an increase of 5 points in NWEA MAP Math scores compared to the lowest usage quintile.

First grade students in the second Istation Math usage quintile and above (>648 minutes/school year) had an increase of 2–5 points in NWEA MAP Math scores compared to the lowest usage quintile.

Second grade students in the third Istation Math usage quintile (956–1214 minutes/school year) had an increase of 2 points. In contrast, students in the fifth Istation Math usage quintile (>1636 minutes/school year) had an increase of 3 points in NWEA MAP Math scores compared to the lowest usage quintile.

Third grade students in the second Istation Math usage quintile and above (>668 minutes/school year) had an increase of 2–5 points in NWEA MAP Math scores compared to the lowest usage quintile.

Table 3. *NWEA MAP Math Regression Model for Kindergarten through Third Grade, Coefficients and Standard Errors (SE)*

Fixed Effects	Kindergarten (n=607)	First Grade (n=725)	Second Grade (n=695)	Third Grade (n=718)
Intercept	33.02* (4.02)	25.93* (3.53)	35.18* (3.79)	26.6* (3.48)
Baseline Score	-0.11* (0.03)	-0.07* (0.02)	-0.12* (0.02)	-0.08* (0.02)
Usage 2 (21-40)	1.73 (0.94)	2.00* (0.89)	0.96 (0.89)	1.53+ (0.79)

Usage 3 (41-60)	1.81⁺ (0.93)	3.33* (0.91)	1.76⁺ (0.89)	1.91* (0.81)
Usage 4 (61-80)	1.50 (0.93)	4.56* (0.91)	1.52 (0.93)	2.91* (0.83)
Usage 5 (>80)	4.85* (0.94)	4.55* (0.93)	3.27* (0.93)	5.02* (0.83)

* $p < 0.05$, ⁺ $p = 0.05$

Fourth Grade

Table 4 shows the results for the HLM model for fourth grade students. Students in the third Istation Math usage quintile or above (>809 total minutes/school year) had an increase of 2–4 points in NWEA MAP Math scores compared to students in the lowest quintile of usage. Sixteen percent (16%) of the variability in scores was due to schools (ICC = .16), leaving 84% of the variability due to students.

Table 4. *NWEA MAP Math Two-Level HLM for Fourth Grade, Coefficients and Standard Errors (SE)*

Fixed Effects	Model 1	Model 2
Intercept	11.83* (0.89)	17.43* (3.84)
Baseline Score		-0.04* (0.02)
Usage 2 (21-40)		1.26 (0.84)
Usage 3 (41-60)		2.32* (0.86)
Usage 4 (61-80)		2.95* (0.88)
Usage 5 (>80)		3.66* (0.95)
Error Variance		
Level-1	48.46* (2.59)	47.34* (2.54)
Level-2 Intercept	5.91* (4.40)	8.78* (7.26)
Model Fit		
AIC	4820.3	4812.7
BIC	4834.0	4849.3

* $p < 0.05$; ICC = .16
Values based on Stata 18.0 Mixed. Entries show parameter estimates with standard errors in parentheses. Estimation Method = REML; Satterthwaite degrees of freedom.

Conclusion

The findings of this study underscore the significant impact of using Istation Math on students' academic growth in mathematics, as measured by the NWEA MAP Math assessment. Across various grade levels from kindergarten to fourth grade, a consistent trend indicates that higher usage of Istation Math correlates with increased gains in NWEA MAP Math scores. Particularly noteworthy is the evidence that students in the higher usage quintiles demonstrated greater improvements compared to those in lower usage quintiles, highlighting the effectiveness of the curriculum in enhancing math learning outcomes measured by the NWEA MAP Math assessment.

This study contributes to the growing body of evidence supporting the use of computer-adaptive curricula in educational settings. By adapting to individual student needs and providing targeted learning pathways, such tools can effectively support academic growth. Furthermore, the study's findings have practical implications for educators and policymakers, suggesting that integrating such adaptive learning tools into the curriculum could be a viable strategy for improving math proficiency among elementary school students.

In conclusion, Istation Math emerges as a valuable resource in the quest to enhance math learning outcomes. As demonstrated by the NWEA MAP Math growth, its effectiveness makes a compelling case for its broader adoption in educational institutions aiming to foster a robust mathematical foundation in their students.

References

Jeans, M. (2024). Linking NWEA MAP Math to Istation Math. Istation.

Ketterlin-Geller, L. (2021). Istation's Indicators of Progress (ISIP) Math Technical Report. Istation.

Marbán, J.M., Radwan,E., Radwan,A., Radwan,W. (2021). Primary and Secondary Students Use Digital Platforms for Mathematics Learning during the COVID-19 Outbreak: The Case of the Gaza Strip. *Mathematics, 9*, 110. https://doi.org/10.3390/math9020110

Mulenga, E., & Marbán, J. (2020). Is COVID-19 the Gateway for Digital Learning in Mathematics Education?. *Contemporary Educational Technology, 12*. https://doi.org/10.30935/cedtech/7949.

Parody, L., Santos, J., Trujillo-Cayado, L., & Ceballos, M. (2022). Gamification in Engineering Education: The Use of Classcraft Platform to Improve Motivation and Academic Performance. *Applied Sciences*. https://doi.org/10.3390/app122211832.

Patarapichayatham, C. & Locke, V. (2023). COVID-19 Learning Recovery Signal. Istation.

Patarapichayatham, C. & Locke, V. (2020a). Linking the ACT Aspire Assessments to ISIP Reading and Math. Istation.

Patarapichayatham, C. & Locke, V. (2020b). Linking the Ohio AIR to ISIP. Istation.

Patarapichayatham, C., Locke, V., & Lewis, S. (2021). Does Computer-Adaptive Curriculum Enhance Students' Achievement in Math? A Quasi-Experimental Study. Istation.

Susaie, C., Tan, C., & Goh, P. (2022). Learning Experience with LearnwithEmma. *Journal of Informatics and Web Engineering*. https://doi.org/10.33093/jiwe.2022.1.2.3.