RESEARCH RESULTS

Go Math! Quasi-Experimental Study: Examination of 2023 Virginia Math Test Scores

STUDY PROFILE

SAMPLE:
234 schools in Virginia

GRADES:
3–6

STUDY DESIGN:
Quasi-Experimental Design

EVALUATION PERIOD:
2022–2023 school year

STUDY CONDUCTED BY:
JEM & R LLC

OUTCOME MEASURE:
Virginia Standards of Learning (SOL)

SCHOOL CHARACTERISTICS

This study included a total of 77 Virginia schools that purchased and adopted HMH *Go Math!*® starting in the 2018–19 school year. Researchers performed confirmation calls with schools/districts to determine the extent to which identified schools have used *Go Math!*. These confirmation calls allowed researchers to determine that potential treatment schools were established *Go Math!* users.

IMPLEMENTATION OVERVIEW

Given the nature of the study, researchers relied on self-report measures from confirmation calls to determine usage of *Go Math!* as their core mathematics program at Grades 3–6. Data collected included: (1) verification of use of the *Go Math!* program and at which grades, and (2) the proportion of students within schools that used this curriculum.

Go Math! is a K–6 math curriculum that aims to guide every learner toward mastery. The curriculum is designed using the 5E instructional model which facilitates student learning by building on previous understanding of mathematical concepts. Formative math assessments are embedded in the program to provide support and "Math Talk" activities which encourage discourse in mathematics. At all *Go Math!* sites, the majority of students (75% or more) at each grade level were taught with the program as their core math instruction.

PARTICIPANTS

The total study consisted of 234 schools with 77 schools using HMH *Go Math!* during the study period and 167 schools serving as the matched sample comparison group.

Given that performance data is available for each grade level, the unit of analyses is *grade level performance* within schools. Therefore, *Go Math!* schools were matched by school level characteristics and grade level performance measures to unique schools within the state.

Table 1 below displays the final grade level units for treatment and comparison schools included in the final analytic sample.

TABLE 1 ANALYTIC SAMPLE SIZE BY GRADE AND COHORT					
Virginia	Grade Level				Total
Group	3	4	5	6*	
Total	149	149	149	14	461
Control	74	74	75	7	230
Go Math!	75	75	74	7	231

*There were a few K-6 elementary schools included in the sample.

Houghton Mifflin Harcourt.
The Learning Company®

MEASURES

Virginia Standards of Learning (SOL)

The Virginia Standards of Learning (SOL) is the state assessment and accountability measure for Virginia students enrolled in a public school district. SOL has been in use since 1998 and provides benchmarks for student knowledge and skills at each grade level. SOL assessments cover a range of subjects including reading, writing, mathematics, science, and history/social science, evaluating student attainment in meeting the Virginia Board of Education's expectations for learning and achievement.

The present study uses math assessment data from the SOL. According to the Virginia Department of Education, the mathematics assessments contain the following domains:

- Number sense—Grades 3, 4, 5, and 6
- Computation and estimation—Grades 3, 4, 5, and 6
- Measurement and geometry—Grades 3, 4, 5, and 6
- Probability and statistics—Grades 3, 4, 5, and 6
- Patterns, functions, and algebra—Grades 3, 4, 5, and 6

The tests were designed to allow the classification of student proficiency into four performance levels (Advanced, Proficient, Basic, and Below Basic). For the present study, percent proficient (i.e., Advanced and Proficient) is the student achievement measure.

Propensity Match Procedures

To evaluate the impact of *Go Math!*, a comparison group was identified using Propensity Score Matching (PSM). PSM was conducted separately for each grade level within school. To create these comparison groups, researchers conducted a three-step process:

Step 1. Computing Propensity Scores
For each unit included in a model, the probability of receiving the *Go Math!* treatment was estimated using a logistic regression model with the *Go Math!* treatment flag as the outcome variable and baseline school/grade level characteristics as predictor variables.

Step 2. Matching
PSM was implemented with MatchIt version 4.5.0 (Ho et al., 2011) using the nearest neighbor matching method with generalized linear model specified as the distance measure and logit specified as the link function. In each PSM model, each *Go Math!* unit was sequentially matched with one potential control unit.

Step 3. Assessing Balance
Equivalence was assessed on key characteristics using a two-sided Independent Sample t-test with a 0.05 alpha-level.

RESULTS

PROPENSITY MATCHING

Statistical analyses were performed to evaluate the match between *Go Math!* students and comparison group students on 13 characteristics (e.g., Percent Proficiency, Percent English language learners), see Table 2. Except for chronic absence, all data is from the baseline year (2017–18). Other school level characteristics available from the Virginia Department of Education website (e.g., percent of experienced teachers, daily membership, absenteeism, etc.) from 2022–23 were analyzed to examine the comparability of schools on current school factors. Analyses revealed a significant difference between the groups for chronic absenteeism, $p <$ .05. As such, this was included in analyses as a covariate in addition to baseline performance to ensure equivalency.

TABLE 2 — DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE (MEANS AND STANDARD DEVIATIONS)			
Group	Category	*Go Math!* (n=224)	Comparison (n=224)
Avg. Baseline Proficiency Overall	--	82.02%	82.43%
Total Enrollment	--	606	589
Gender (% in School)	Male	51.31%	51.26%
	Female	48.12%	48.35%
Race/Ethnicity (% in School)	White	55.70%	57.90%
	African American	8.10%	8.56%
	Hispanic	16.37%	14.61%
	Asian	14.37%	13.26%
	Native Hawaiian / Pacific Islander	0.11%	0.12%
	Multi-Racial	0.96%	0.75%
Subpopulations (% in School)	English Language Learner	13.16%	11.09%
	Students with Disabilities	12.86%	13.28%
	Chronically Absent* (2022-23)	17.68%	13.29%

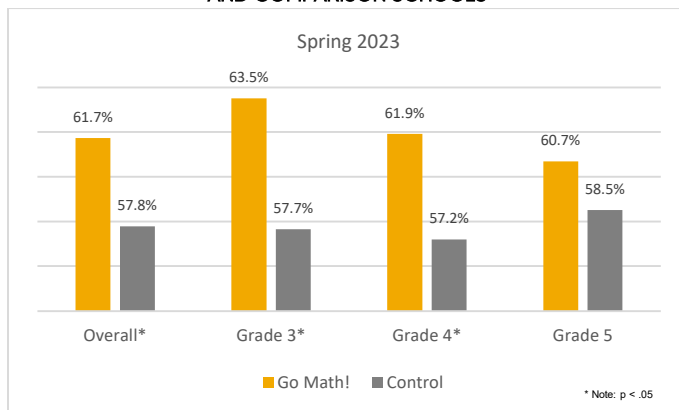*Covariate significant at p<.05 level.

IMPACT OF *GO MATH*!

Math performance of schools that used the *Go Math!* program was compared to closely matched schools using existing state assessment data from Spring 2023, while controlling for 2018 baseline math performance and chronic absenteeism.

Overall analyses of the main effects show that schools using *Go Math!* demonstrated a significantly higher proficiency rate than non-users, p<.05. The percent of students proficient in math was 4.0% points higher among *Go Math!* schools as compared to control schools (d=.39).

Grade level analysis revealed a similar trend in which *Go Math!* users demonstrated higher proficiency rates than comparison schools in Grades 3-5. These findings were statistically significant for Grade 3 and Grade 4, $p < .05$. Note that while sixth graders were included in the overall analyses as they were part of the student population among K-6 schools, results are not broken out by this grade level given the very small sample of sixth grade schools (seven in each group); results by this subgroup are unreliable and therefore not presented.

FIGURE 1.
SPRING 2023 OVERALL ESTIMATED MARGINAL MEANS FOR *GO MATH*! AND COMPARISON SCHOOLS

Spring 2023

	Go Math!	Control
Overall*	61.7%	57.8%
Grade 3*	63.5%	57.7%
Grade 4*	61.9%	57.2%
Grade 5	60.7%	58.5%

* Note: p < .05

Subgroup analyses were also performed to determine if *Go Math!* had a differential impact on certain student populations. Positive trends were observed for all subgroups. Statistically significant results were observed for males, females, White, and economically disadvantaged students, *p* < .05. Marginally significant results were obtained for English language learners (see Table 3), *p* < .10.

TABLE 3. SPRING 2023 ESTIMATED MARGINA MEANS FOR *GO MATH!* AND COMPARISON SCHOOLS AS A FUNCTION OF SUBGROUP				
Subgroup	*Go Math!*	Comparison	Difference	Sign.
Male	60.1	57.2	2.9	*
Female	63.4	58.8	4.6	*
White	66.8	63.1	3.7	*
African American	59.9	56.1	3.8	--
Hispanic	56.1	54.3	1.8	--
Disadvantaged	57.4	53.4	4.0	*
ELL	51.7	46.8	4.9	**
Students with Disabilities	54.0	51.8	2.2	--

Note: * p < .05,
   ** p < .10

CONCLUSION

Results from the *Go Math!* quasi-experimental study showed that *Go Math!* usage is associated with positive effects in student math performance in Virginia.

Higher proficiency rates were observed in schools that used *Go Math!* over control schools with statistically significant differences, *p* < .05.

Examination of results within each grade level also showed a similar positive pattern of results. In general, *Go Math!* users demonstrated higher proficiency rates for students in Grades 3–5, as well as all subgroups examined. Furthermore, these differences were statistically significant for Grade 3, Grade 4, male, female, White, and economically disadvantaged students and marginally significant for English language learner students.

While the results are encouraging, the study has several limitations that should be considered when interpreting results. Teachers generally teach similar math concepts and, due to state and local curricular guidelines which are typically aligned to state assessments, tend to cover similar content (e.g., fractions, algebra, etc.). This means that small effects are likely.

The Virginia Department of Education masks data for students in subgroups with less than 10 students; as such, the data from *Go Math!* schools does not represent all impacted students.

Researchers were unable to obtain implementation data on how well teachers administered the program and their level of fidelity to the learning model. Such data could reveal stronger effects as program implementation is a known mediator when conducting curricula research.

Lastly, quasi-experimental studies like these rely on existing users. Thus, the analysis cannot completely rule out other potential external factors that could be leading to these results. However, the statistical procedures put into place and the consistency of the findings increase the confidence that usage of *Go Math!* was the underlying mechanism leading to the significant differences between treatment and comparison.

Despite these limitations, the results from this quasi-experimental study using Virginia state assessment data provides evidence that *Go Math!* is an effective math program that can help accelerate student learning.