

Data-Driven Metrics Research Summary

Underwater Math's Targeted Practice System's Impact on Elementary Student's Mastery of State Mathematical Standards

ABOUT

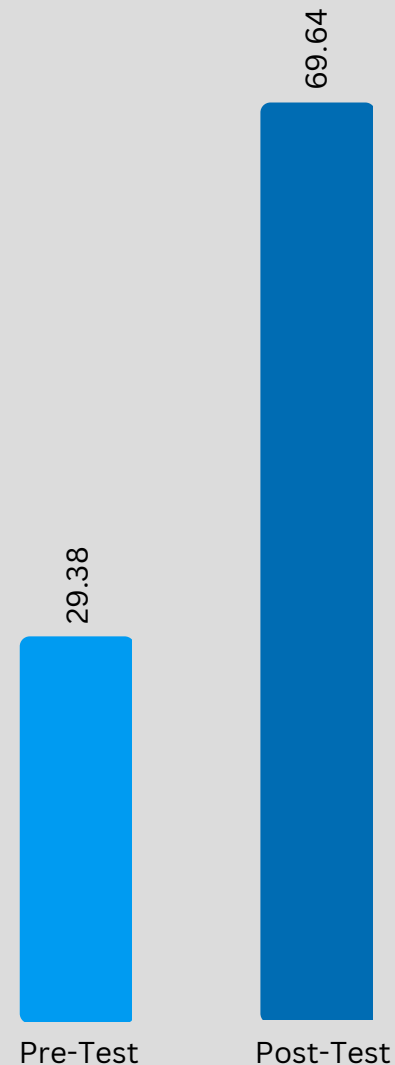
This study, conducted by Data-Driven Metrics, assessed the effectiveness of the Underwater Math online program in improving elementary students' math performance. The study was conducted on students in grades 2-5 who used the program for the first time during the 2022/23 school year. Pre- and post-tests were administered to measure the program's impact on students' math abilities. The results indicated that using Underwater Math positively and significantly impacted students' math skills from pre-test to post-test. This study adheres to Tier 3 (Promising Evidence) under the Every Student Succeeds Act (ESSA).

RESULTS

The results of this study conducted by Data-Driven Metrics found that Underwater Math's targeted practice system is effective in improving students' understanding and performance within the math standards. Students scoring under 75% on the pre-test see a **24% increase**. Students scoring under 50% see a **40% increase** after using Underwater Math's Skill Builder for adaptive remediation.

Adaptive Remediation Results

Pre-Test to Post-Test results after completing Underwater Math's Skill Builder and Targeted Practice sessions.



Adaptive Remediation results show Pre-Test scores for students who scored lower than 50% on their Pre-Test and their average Post-Test scores.





Data-Driven Metrics
Insightful Metrics. Informed Decisions



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Conducted by:
Data-Driven Metrics

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Overview

The aim of this study is to assess the influence of the *Underwater Math* online, adaptive, and personalized program on students' mathematical performance. Specifically, the study focused on students in grades 2-5 who were using *Underwater Math* for the first time during the 2022/23 school year. The research design measured growth from students taking a pre-test on a specific standard, working within *Underwater Math's* adaptive targeted practice system, and subsequently taking a post-test on the same standard. By comparing the pre-test and post-test results for each standard, the study sought to understand the program's impact on students' mathematical abilities.

Results of the study revealed a ***statistically significant and positive impact of Underwater Math on student performance*** from pre-test to post-test. The improvements were observed across grades 2-5, suggesting the potential for *Underwater Math* to be an ***effective tool in supporting student growth in elementary mathematics education***. Further research is needed to explore the long-term impact of *Underwater Math* on students' achievement in mathematics.

Underwater Math's Program Description

Underwater Math is an innovative online adaptive practice and instruction program designed to enhance mathematics achievement for students in grades 2-5.¹ The program utilizes a unique underwater theme to engage students in an immersive learning environment, making math practice enjoyable and interactive. *Underwater Math* is built on a robust learning platform that emphasizes individualized learning, targeting each student's specific needs in mathematics.

Key features of the *Underwater Math* program include:

- 1) **Adaptive Targeted Practice:** The program begins by assessing each student's current understanding of mathematical concepts through a pre-test. *Underwater Math* isolates every state standard to its individual breakouts (specific skills within the standard), enabling a customized targeted practice experience. Based on the pre-test results, *Underwater Math's* adaptive algorithm generates a personalized learning pathway, offering practice questions and instructional materials tailored to the student's needs. By focusing on the specific skills students require while not spending time on areas they have already shown mastery, the program ensures efficient and effective learning.
- 2) **Engaging Content:** *Underwater Math* presents mathematical concepts through an appealing underwater theme, incorporating vivid visuals and interactive elements to

¹ Underwater Math. (n.d.). Deep TEKS Mastery: Targeted Practice. Retrieved April 1, 2023, from <https://underwatermath.com/wp-content/uploads/2023/02/Texas-Deep-TEKS-Mastery.pdf>.

maintain student interest and motivation. By making math practice fun and engaging, students are more likely to persevere and build essential mathematical skills.

- 3) Progress Reporting: *Underwater Math* offers real-time progress tracking, enabling teachers and parents to monitor student performance and growth. Detailed reports provide insights into each student's strengths and areas for improvement, allowing educators to make data-driven decisions to support their students effectively.
- 4) Post-Test Assessments: After working through the adaptive targeted practice, students complete a post-test on the same standard to measure their growth and understanding of the mathematical concepts. The comparison of pre-test and post-test results provides valuable insights into the program's effectiveness in improving student performance.
- 5) Alignment with Curriculum Standards: *Underwater Math* is designed to align with state and national curriculum standards, ensuring that students are learning and mastering the skills necessary for academic success.

By combining adaptive targeted practice, engaging content, and comprehensive progress reporting, the goal of *Underwater Math* is to provide an effective and enjoyable learning experience for students, helping them build a strong foundation in mathematics and achieve academic success.

Research Design

The current study aimed to answer the following research questions:

- Is there a significant change in students' mastery of specific skills within state standards in mathematics following participation in the *Underwater Math* program?
- Did students identified for targeted remediation on specific standards in the *Underwater Math* program experience a significant change in the mastery of those skills?

These research questions were addressed through a pre-post study design, focusing on the scores of students from grades 2 to 5 who used *Underwater Math*'s targeted adaptive practice system for the first time during the 2022/23 school year. Data collected included pre-test and post-test scores for each student, which were analyzed to determine the program's impact on student performance.

The primary steps of the research design includes:

- 1) Data collection: *Underwater Math* collects pre-test and post-test scores for each student. These tests assess student mastery of specific skills within each state standard, which forms the basis for the program's targeted adaptive practice.

- 2) Sample selection: All students who completed a pre- and post-test on the same standard during the 2022/23 school year were included in the study. Students scoring 88% or better on the pre-test do not receive adaptive practice and advance to the next topic without taking a post-test. In addition, students completing more than one pre- and post-test on the same topic were excluded from the analysis (n=26).
- 3) Data analysis: Pre- and post-test scores were analyzed to quantify student growth and determine the level of impact the program is having on learners. Descriptive statistics provided an initial understanding of the overall performance and distribution of the scores. A paired t-test was used to statistically compare the pre- and post-test scores and calculate the effect size of the program. Subgroup analysis was used to examine the program's effectiveness for students scoring below 50% on their pre-test. Students scoring below 50% on the pre-test automatically receive mandatory remediation that includes vocabulary and skill-building.
- 4) Interpretation of results: The results of the data analysis are used to assess the effectiveness of the *Underwater Math* program in improving student performance in mathematics. The effect size, t-value, and p-value are reported, along with any additional insights gained from the study.

This research design aims to provide a thorough evaluation of the *Underwater Math* program, offering valuable insights into its effectiveness in helping students achieve mastery of specific skills within each state standard. The study's findings can be used to inform educators, administrators, and other stakeholders about the benefits of implementing *Underwater Math* in their schools.

This study adheres to the criteria for **Tier 3 (Promising Evidence) under the *Every Student Succeeds Act (ESSA)***.² The research design employed in this evaluation, which involves a pre- and post-test assessment of the targeted practice system, is a well-executed correlational study. By aligning with the ESSA Tier 3 requirements, this study demonstrates a commitment to methodologically sound research practices, which can help guide evidence-based decision-making in educational settings.

Results

Descriptive Statistics

The 283 students from 26 different elementary schools included in this analysis completed 502 total pre-test, targeted practice, and post-test cycles for different math standards in which they scored lower than 88% on the pre-test. A subset of 61 students who scored below 50% on the

² U.S. Department of Education. (2016). Non-regulatory guidance: Using evidence to strengthen education investments. Retrieved from <https://www2.ed.gov/policy/elsec/leg/essa/guidanceusesinvestment.pdf>

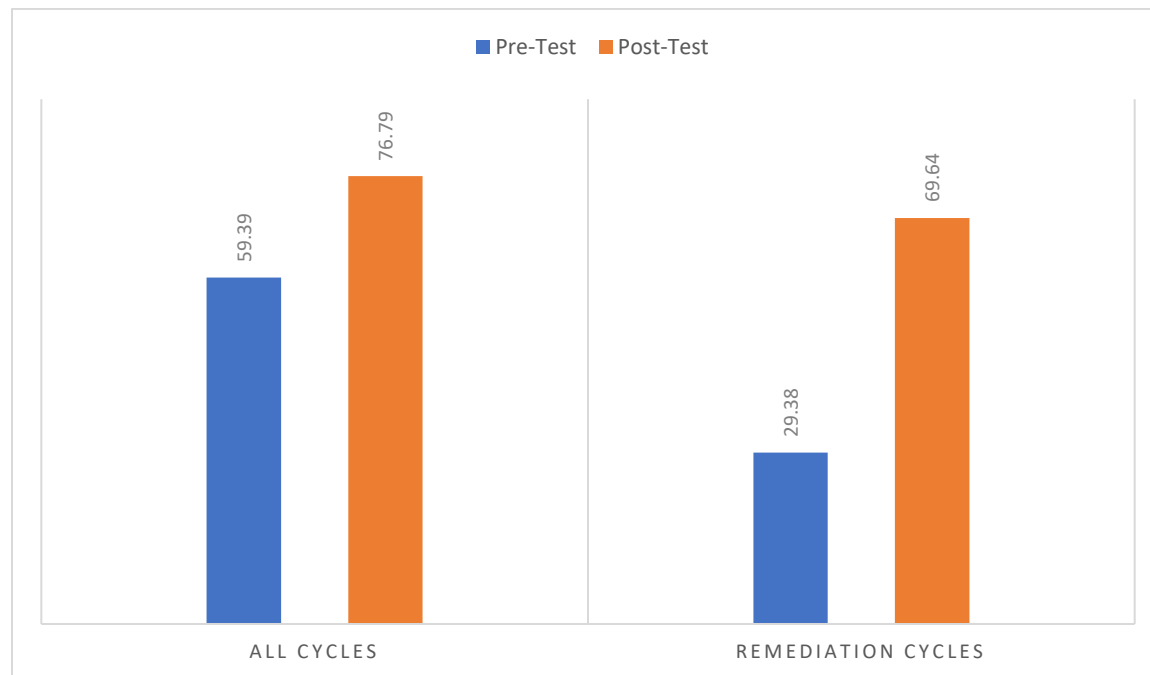
pre-test and received mandatory remediation prior to completing the post-test completed 77 cycles.

Table 1. Descriptive Statistics for Assessment Cycles

Metric	All Assessment Cycles	Pre-Test < 50%
Number of Students	283	61
Number of Assessment Cycles	502	77
Average Pre-test	59.39	29.38
Average Post-test	76.79	69.64
Growth Rate	70.92%	93.51%
Average Growth	17.41	40.26

As depicted in Table 1, analysis of descriptive statistics suggest students' understanding of the topics increased with exposure to the targeted practice modules. The average pre-test score was 59.39, while the average post-test score increased to 76.79 (see Figure 1). This indicates a substantial improvement in students' performance after participating in the *Underwater Math* program. Notably, 70.92% of the post-tests taken showed some growth in student performance.

Figure 1. Pre- and Post-test Averages for Assessment Cycles



Students identified as needing targeted remediation in the pre-assessment, as indicated by scoring 50% or below, demonstrated impressive growth. The average pre-test score for this subgroup was 29.38, compared to an average post-test score of 69.64 (see Figure 1). Nearly all of these students (93.51%) demonstrated some growth on their post-test, and 88.31% scored 50% or above on their post-test.

Table 2. Assessment Growth by Pre-Test Score

Pre-Test Score	Average Post-Test	Average Growth	Growth Rate
0.00	59.38	59.38	100.00%
12.50	57.50	45.00	90.00%
25.00	74.31	49.31	100.00%
37.50	71.39	33.89	91.11%
50.00	72.30	22.30	79.41%
62.50	78.08	15.58	69.72%
75.00	81.35	6.35	57.46%

With the understanding that higher pre-test scores mitigate the amount of growth a student can demonstrate on their post-test, the majority of students in each pre-test scoring category demonstrated some improvement on their post-test, as indicated by the growth rate reported in Table 2. This finding was most relevant for students who scored below 50% on their pre-test, as they have more room for growth. However, the pattern persisted, albeit to a lesser extent, for students scoring 50% or greater on their pre-test.

Inferential Statistics

Inferential statistical analysis using a paired t-test was conducted to evaluate the impact of Underwater Math targeted practice on student performance (Table 3). For all assessment cycles, there was a statistically significant increase in scores from pre-test ($M = 59.39$, $SD = 16.32$) to post-test ($M = 76.79$, $SD = 19.90$), $t(501) = -17.25$, $p < .001$ (two-tailed). The mean increase in assessment scores was 17.41 with a 95% confidence interval ranging from 15.42 to 19.39. The observed effect size for all assessment cycles was medium but nearing large, as indicated by the Cohen's d statistic (-0.77).

Table 3. Paired Samples T-Test for Assessment Cycles

	Pre-Test		Post-Test		Mean Difference	t-value	p-value ^a	Cohen's d^b
	Mean	SD	Mean	SD				
All Cycles	59.39	16.32	76.79	19.90	-17.41	-17.25	.000	-0.77
Remediation Cycles	29.38	11.25	69.64	21.50	-40.26	-15.86	.000	-1.81

a. p -values ≤ 0.05 are considered statistically significant

b. Effect sizes $\geq .2$ are considered small, $\geq .5$ are considered moderate, $\geq .8$ are considered large

Statistically significant and positive results were also observed in the subset of students who received mandatory remediation. The mean increase in assessment scores for students completing remediation cycles was 40.26 with a 95% confidence interval ranging from 35.21 to 45.32. A large effect size was observed, as indicated by the Cohen's d statistic (-1.81).

These results provide strong evidence of the effectiveness of the *Underwater Math* program in improving students' performance in math standards. The observed improvements were statistically significant and accompanied by a medium and large effect size, demonstrating the potential value of the program for enhancing student achievement in mathematics.

Conclusion and Recommendations

The results of this study demonstrate that *Underwater Math*'s targeted practice system is effective in improving students' understanding and performance in specific math standards. The analysis of pre-test and post-test data revealed a significant increase in students' scores, with an average growth rate of 70.92% for all assessment cycles and 93.51% for remediation assessment cycles. Furthermore, the t-value, p-value, and Cohen's d effect size all support the effectiveness of the *Underwater Math* program.

Based on these findings, we can conclude that *Underwater Math* is a valuable educational tool for enhancing students' math skills and overall academic performance. The program's unique approach of isolating individual state standards and providing targeted practice tailored to students' specific needs has been shown to produce positive results.

Recommendations for educators and administrators include:

- 1) Consider implementing *Underwater Math* as a supplemental tool in math classrooms to support students who may be struggling with specific math standards.
- 2) Monitor student progress and performance within the program to ensure they are receiving the appropriate level of targeted practice and support.
- 3) Encourage teachers to incorporate *Underwater Math* into their lesson plans and use the data provided by the program to inform instructional decisions.
- 4) Provide professional development and training for teachers on how to effectively use *Underwater Math* to maximize its impact on student learning.

It is important to note that this study focused on a sample of students in grades 2-5 who had not previously used *Underwater Math*. Further research could be conducted to explore the long-term effects of the program on students' math performance, as well as its efficacy across different grade levels and standards. Additionally, future studies could investigate the potential benefits of combining *Underwater Math* with other instructional strategies and programs to further enhance student outcomes.

About Data-Driven Metrics

Data-Driven Metrics provides data-driven consultation and solutions to companies in and serving the public sector. Specializing in program evaluation, assessment, performance metrics, and improving efficiencies in business processes, the primary researcher has more than two decades of experience in research and 15 years of experience researching in the public sector. The company primarily focuses on research involving youth in various public domains, such as education, juvenile justice, and behavioral health. www.datadrivenmetrics.com



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