

# Raising the Bar District-Wide

## Using Symphony Math

Symphony Learning: Research Study 06 20 2019  
Paul Schwarz, M Ed.

### Abstract

*Students and staff from Graves County, Kentucky, participated in a study during the 2018-19 school year to examine the effect of the Symphony Math foundational numeracy program in grades 1 through 4. In order to provide comparison, approximately half the population used Symphony Math as their sole technology intervention, while the other half participated in the standard district math curriculum, which combined different online and offline resources. As students used Symphony Math, teachers were able to monitor their progress and provide interventions when necessary using data dashboards and recommended offline materials. District policy included administration of the STAR® Math assessment to the full student population at several dates during the school year. The results from this third-party testing show that students who used Symphony Math made significant gains in math achievement and, on average, outperformed their peers in the district who did not use the program.*

### Introduction

A number of research studies have demonstrated that struggling math students often have an underdeveloped understanding of foundational numeracy. Graves County Schools are located in the western region of Kentucky. The student population in the district was 4,073 in 2017. The demographic makeup of the district is over 87% White (non-Hispanic), and over 57% of students qualify for free or reduced lunch. After being introduced to Symphony Math through a local company, the district began a pilot of Symphony Math in August of 2018. In October 2018 the pilot was refined to focus on early elementary students. Since several populations had not used the program, the district agreed to participate in a study by Symphony Learning designed to measure the difference in achievement between students who used Symphony Math and students who did not use the program. This report summarizes the implementation of the program and subsequent results.

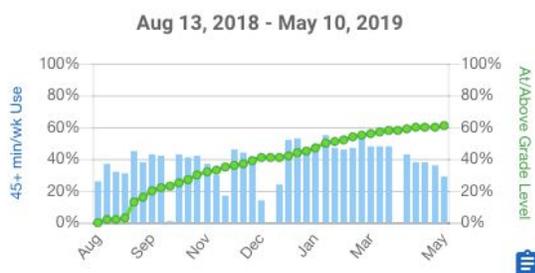
### Participants

Students from Graves County Schools in grades K-4 participated in the use of Symphony Math during the 2018-19 school year. Only grades 1-4 were used in this analysis due to the lack of consistent third-party testing results in the Kindergarten population. The treatment group, who used Symphony Math, came from 5 of the 7 elementary schools in grades 1 and 2, and two of the schools in grades 3 and 4. The control group, who did not use Symphony Math, was comprised of 2 elementary schools in grades 1 and 2, and 5 elementary schools in grades 3 and 4. Overall, the numbers for the treatment group and control group were similar (treatment n=580, control n=634).

## Implementation

The Elementary Instructional Supervisor in Graves County received initial training and support from a qualified Symphony Math regional representative, including several on-site visits, telephone, and email support. A goal of 45 minutes of use per week for students was set. Student use was shown to be consistent throughout the school year, as is shown in Figure A.

In addition, each participating school received an additional in-person training in October 2018. Each grade level team participated in a 30-minute information session that focused on data analysis and use of the program's offline materials in order to better support students as they used Symphony Math.



**Figure A: Use of Symphony Math in Graves County**

The blue bars throughout the school year show that many students used Symphony Math at least 45 minutes per week consistently throughout the school year. An average of 22.8 hours use was noted across the entire population of students. While there was variance noted between individual students and classrooms (see Appendix A), no distinction was made for the purposes of analysis in this study. If students used Symphony Math, their data was reported in the treatment group regardless of time spent on the program.

## Intervention

Symphony Math is an intervention program designed to help students develop a profound understanding of the most important mathematical concepts. Many students struggle to become proficient in math because they do not

have the opportunity to master foundational concepts with sufficient depth. In an age when most curricula value covering a large number of topics, some students are falling through the cracks. They need more time and more practice working with the big ideas of mathematics in order to develop the proper foundation.

Symphony Math provides students with the experience of learning and thinking about the most important mathematical concepts. This experience provides the necessary foundation for a successful future of math learning. Symphony Math helps students achieve this solid mathematical foundation by implementing several key research-based pedagogic strategies.

The conceptual sequence of Symphony Math consists of a tightly connected progression of the most important mathematical ideas. These underlying "big ideas" are important because they provide the foundation for later mathematical learning. A student does not move on to the next concept in the Symphony Math sequence until she has mastered the current concept. One concept follows logically from the previous concept. While a student is working on a new concept she sees review concepts that help support her learning of the new concept. This process helps the student connect new knowledge to previous knowledge.

Symphony Math uses visual models to help students formalize their understanding of foundational number sense concepts. Students construct bar models, counting dots, number lines, grids, and fraction strips in their investigation of the most important ideas in mathematics. A concrete-to-abstract approach gradually introduces symbols, and always uses models in the justification of correct solutions.

The pedagogic style of Symphony Math emphasizes thinking, figuring out, and making connections. The program is designed to be used as a complement to the classroom learning experience. Students receive direct instruction and group learning in a classroom setting. The program provides the opportunity for individual

practice at the developmental level of each student. The style of this practice encourages independent thinking and problem solving, and this is accomplished through the use of these important pedagogic strategies.

Symphony Math works with each student at his or her developmental level. The “dynamic branching” of the program and detailed progression of the scope and sequence allows students to work within their developmental zones. The amount of time and practice that students need to understand mathematical concepts is not uniform. Symphony Math allows students to spend the time they need in order to master foundational concepts. In addition, the program quickly moves students through the conceptual progression of the program to identify their area of need. Once the area of need has been identified, the program slows the progress until the necessary understanding has been achieved.

In addition to adjusting the pace of progress, Symphony Math also alerts educators of the need for intervention when students show signs of struggle. For every skill covered in the program, offline Guided Practice materials are available. Educators can use these materials to structure small group or 1:1 work sessions with students. The offline materials offer a chance for educators and students to express their understanding of difficult topics, and they are an important key to successful implementations.

## Assessment

All participating students were given the STAR 360® Math assessment (STAR), by Renaissance Learning, several times during the 2018-19 school year. The assessment provides scale scores, percentile ranks, and grade equivalents for students based on norm referenced scores. The multiple administrations of testing allow for comparisons in growth during the school year.

## Analysis

This study compares results on the STAR assessment in grades 1 through 4 between the treatment and control groups. The assessment was administered at the beginning of the school year (August), late fall (early November), winter (February), and spring (April). The results provided for this analysis compared student results in the first and last administrations of the assessment. In order to analyze the group data, mean percentiles from 29 class groupings from each of the control and treatment groups were used. For example, at School A in Grade 1 in class grouping A there were 17 students ( $n = 17$ ), these 17 students’ pre-test scores were averaged into a pre-test mean score and their post-test scores were averaged into a post-test mean score.

The intention was to conduct independent samples t-tests on the students’ scale scores (SS), percentile ranks (PR), and grade equivalents (GLE) scores. However, violations of normality occurred for all three test types (PR, GLE, and SS). It was determined that GLE probably violated the assumption of normality, because there were an uneven number of groupings in the various grades and GLE reflects grade-level equivalent. Therefore, GLE was not considered in further analysis.

Furthermore, it was determined that in the control group for the post-PR test, one group was a significant outlier; however, the researcher did not remove this outlier due to the small sample size. Based on the violations of normality, a Mann-Whitney U Test was used to compare the groups on their pre-PR and pre-SS scores. The treatment ( $n = 29$ ) and control ( $n = 29$ ) groups were significantly different on their pre-SS scores, ( $U = 211, Z = -3.26, p < .001$ ). The median for the control group for pre-SS was 558 (quartile range: 476.50 to 632.50), the treatment group’s median was 446 (quartile range: 322 to 476.50). Based on these results the SS was removed from analysis. The treatment ( $n = 29$ ) and control ( $n = 29$ ) groups were not significantly different on their pre-PR scores, ( $U = 381, Z = -.615, p = .539$ ). The

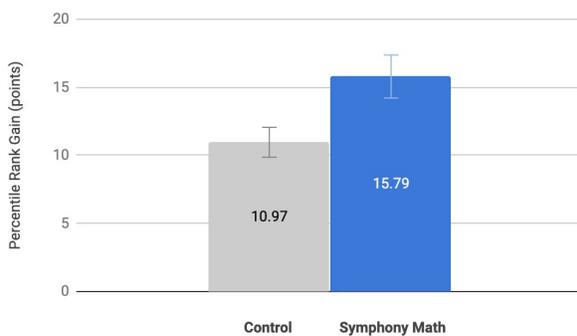
median for the control group for pre-PR was 66 (quartile range: 59.50 to 75.50), the treatment group’s median was 70 (quartile range: 63.50 to 75.50). Based on these results a Mann-Whitney U Test was conducted on PR Gain Scores (post-PR minus pre-PR).

## Results

A Mann-Whitney U test revealed that the treatment (n = 29) and control (n = 29) groups were significantly different on their post-PR gain scores, (U = 203.50, Z = -3.38, p < .001). The median for the control group for post-PR gain score was 79 (quartile range: 71.50 to 84.50), the treatment group’s median was 85 (quartile range: 82.50 to 89.50).

Comparison of results from the STAR assessment from fall to spring showed a significant difference in gains in Percentile Rank using 29 groups from the Symphony group (n=580) and 29 groups from the control group (n=634).

Gains in Percentile Rank: STAR Math



Group	n	Fall 2018		Spring 2019		Gain
		Mean	SD	Mean	SD	
Symphony	29	69.28	7.78	85.07	6.96	15.79**
Control	29	66.17	14.42	77.14	10.56	10.97

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\*\* Statistically significant at the p<0.01 level

Students who used Symphony Math were seen to gain an average of 15.79 Percentile points during the course of the school year. Their peers who did not use Symphony Math gained an average of 10.97 Percentile points.

## Conclusion

Graves County identified foundational number sense as a critical need of all students. During the 2018-19 school year, a study was undertaken to research the results of adding Symphony Math to support students in the goal of mastering key components of numeracy that enable math success. The district implemented the program as a regular part of students’ week, and also supported teachers by including data review and focused Math Specialist interventions for struggling students.

When observing growth as measured by an independent assessment instrument, and comparing students to their peers in the district, students who used Symphony Math made significant growth during the course of the school year, and also outperformed their peers.

## Appendix A: Data

### STAR Math Assessment Data per grouping (and Symphony Math Use)

School	Grade	Class Grouping	Pre Percentile Rank	Post Percentile Rank	<i>n</i>	(No Symphony Math Use)
Control						
School A	1	A	70	89	17	
School A	1	B	38	64	16	
School B	1	A	62	81	24	
School A	2	C	47	68	18	
School A	2	D	62	82	26	
School A	2	E	76	86	25	
School B	2	B	60	76	27	
School C	3	A	82	79	16	
School C	3	B	93	93	17	
School D	3	A	59	75	25	
School D	3	B	82	87	34	
School A	3	F	64	78	19	
School A	3	G	78	84	23	
School A	3	H	64	78	19	
School B	3	C	52	67	21	
School B	3	D	63	76	20	
School E	3	A	36	59	18	
School E	3	B	74	75	18	
School C	4	C	71	80	21	
School F	4	A	75	85	43	
School D	4	C	36	44	25	
School D	4	D	88	93	32	
School A	4	I	75	74	23	
School A	4	J	64	67	22	
School A	4	K	74	69	20	
School B	4	E	66	79	17	
School B	4	F	72	81	17	
School E	4	C	78	89	14	
School E	4	D	58	79	17	

Treatment (Symphony)						
School	Grade	Class Grouping	Pre Percentile Rank	Post Percentile Rank	<i>n</i>	<i>Avg. Use Symphony Math (hours)</i>
School F	1	B	64	83	20	28
School F	1	C	68	75	19	22
School F	1	D	78	93	19	31.5
School E	1	E	62	89	20	31
School E	1	F	56	83	20	22.5
School D	1	E	70	89	18	14.5
School D	1	F	71	88	19	6
School D	1	G	67	84	18	17
School C	1	D	85	94	14	24.5
School C	1	E	81	95	15	24.5
School G	1	A	66	85	17	24
School G	1	B	62	79	15	24
School F	2	E	71	82	18	23
School F	2	F	62	71	19	23
School F	2	G	63	80	20	23
School E	2	G	67	84	16	38
School E	2	H	76	87	14	38
School D	2	H	69	85	18	19
School D	2	I	73	85	17	16
School D	2	J	76	90	17	17.5
School C	2	F	58	90	20	19
School G	2	C	76	94	21	24
School G	2	D	71	91	22	24
School F	3	H	70	83	52	24
School G	3	E	75	86	19	20
School G	3	F	81	88	19	20
School F	4	I	51	63	21	26
School G	4	G	67	82	26	19.5
School G	4	H	73	89	27	19.5

# Acknowledgments

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