

Based on data from the
2017–2018 academic year



Research on Program Impact of *Ready Mathematics* Blended Core Curriculum

.....
Efficacy Research for *Ready Mathematics* and ESSA
.....

Curriculum Associates Research Brief | March 2019

The Impact of *Ready Mathematics* Blended Core Curriculum

Research Overview

The Human Resources Research Organization (HumRRO), a nationally recognized third-party evaluator, conducted an evaluation to examine the impact of the *Ready Mathematics* Blended Core Curriculum on mathematics achievement for students in grades K–5. This study was designed to meet the required rigor of the What Works Clearinghouse (WWC) 4.0 standards for quasi-experimental studies (WWC, 2017a), and to meet guidelines for a Level 2 rating for the Every Student Succeeds Act (ESSA) guidance for evidence-based research (U.S. Department of Education, 2016). This was achieved by using quasi-experimental design in which baseline equivalence was established between the treatment and comparison groups. For the analysis, an outcome measure acceptable to WWC was used, and baseline achievement was included as a covariate. Additionally, a sampling design that mitigates the effects of any confounding factors was employed. HumRRO's findings provide evidence that school-level participation in *Ready Mathematics* resulted in higher student-level achievement in mathematics, as measured by the *i-Ready*® *Diagnostic*, compared to a control group composed of similar students.

Research Questions and Study Design

The primary purpose of this evaluation was to estimate the impact of using *Ready Mathematics* Blended Core Curriculum on student achievement. Particularly, HumRRO was interested in how the use of the three primary components that make up *Ready Mathematics* Blended Core Curriculum (*Ready Mathematics* curriculum, *i-Ready Personalized Instruction*, and *i-Ready Diagnostic*) impact student achievement in mathematics beyond the use of *i-Ready Diagnostic* assessment for mathematics only. As such, the research was focused on one primary research question, addressed separately for each grade from kindergarten to grade 5:

What is the impact of *Ready Mathematics* Blended Core Curriculum on student achievement in mathematics compared to a control group consisting of students who only took the *i-Ready Diagnostic* assessment?

Research Sample Definition

For a school to have implemented the *Ready Mathematics* Blended Core Curriculum (*Ready Mathematics* for the purposes of this brief) with adequate fidelity, it needed to meet the following eligibility criteria:

- Have adopted the *Ready Mathematics* curriculum as the school's primary core mathematics curriculum. This was determined through structured interviews with Curriculum Associates staff who had worked closely with the *Ready Mathematics* districts and schools. HumRRO eliminated those schools and districts that had not yet established *Ready Mathematics* as their primary curriculum.
- Show strong use of *i-Ready Personalized Instruction*, with most *i-Ready* student users engaging with Personalized Instruction for an average of at least 30 minutes per week for a minimum of 18 weeks between the fall and spring *i-Ready Diagnostic* administrations. Information on this eligibility criterion was obtained through review of *i-Ready* data.

- Administer the *i-Ready Diagnostic* for mathematics a minimum of two times during the school year—fall and spring—to the majority of the students in each school. This study was focused on full-class implementations; schools using the program with select populations of students, such as those in need of interventions, were eliminated from the study. Information on this eligibility criterion was obtained through review of *i-Ready* data. The administration of the *i-Ready Diagnostic* was important as it was used as the outcome variable for this study.

Study Design

Once schools meeting the eligibility criteria for the treatment and comparison group were identified, matching was conducted to select comparable groups of schools and students. First, matching was conducted at the school level to ensure key school demographic characteristics were similar between the groups of treatment schools and control schools. Schools were matched on the following variables:

- Percentage of students eligible for free- or reduced-price lunch (FRL)
- Percentage of students with limited English proficiency (LEP)
- Percentage of students with disabilities (SWD)
- Percentage of students who identify as Caucasian and non-Caucasian

These variables were selected as they are known to be related to student achievement, and reliable data are available for public schools across the country, including all schools meeting the criteria for our sample. Baseline equivalency was successfully established for all grades. A total of 32 schools with over 9,000 students from three states made up the treatment group; these students were compared with 12,000 comparable students from across the country in the control group.

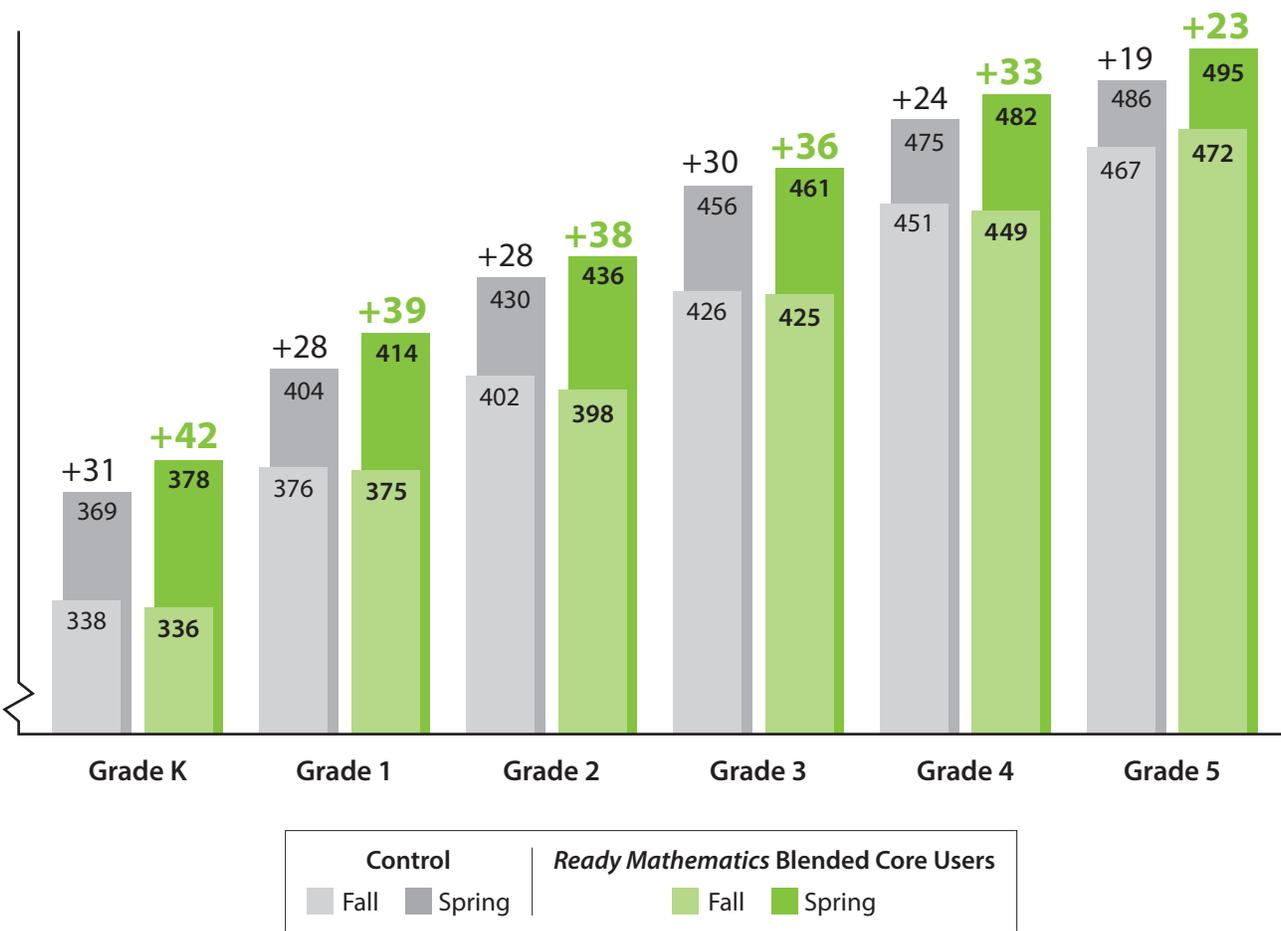
Following school-level matching, HumRRO compared the baseline student-level mathematics achievement, using fall *i-Ready Diagnostic* scores, separately at each grade level for all students in the sampled treatment and comparison schools. For grades 1 through 5, baseline equivalence was accomplished at the student level on the fall 2017 mathematics achievement measure using all students in the schools. Student-level matching was required at kindergarten to create samples of students with baseline mathematics achievement within the WWC established threshold. For grade K, student-level matching was conducted using propensity score matching similar to what was used for the school matching. HumRRO used the fall 2017 mathematics *i-Ready Diagnostic* score as the matching variable. For grade K, HumRRO matched one comparison student to each treatment student.

Following the selection of baseline equivalent groups, hierarchical linear modeling (HLM) was used to estimate the impact of *Ready Mathematics* on student mathematics achievement. A two-level model was used to account for the clustered nature of the data with students nested within schools. Because effect size differences between the treatment and comparison on student achievement at baseline fell between .05 and .25 standard deviations, baseline mathematics achievement was included in the model as a covariate. To indicate the size of impacts, effect sizes were computed for all comparisons using Hedge's *g* with an adjustment for small sample sizes (WWC, 2017b). Hedge's *g* is nearly identical to Cohen's *d* and has the same interpretation, but is more appropriate for analyses with fewer students or schools.

Results

The *Ready Mathematics* schools were found to perform significantly better than the control schools on mathematics achievement as measured by students' *i-Ready Diagnostic* for all grades K–5 (see Figure 1 and Table 1). The p -values for the analysis were well below the .05 WWC threshold. The effect sizes, as measured by Hedge's g , ranged from .17 (grade 3) to .36 (grades K and 1). The average scale score difference between fall and spring for the control group was 27 points, whereas the average difference for the treatment group was 35 points. Looking solely at differences on the spring assessments and recognizing that baseline pretest scores for the treatment and control groups are proximately equivalent, the results provide evidence that students using *Ready Mathematics* in grades K–5 grew, on average, approximately 5–10 scale score points more than students using other programs.

Figure 1. *i-Ready Diagnostic* (Math) Scale Score Differences



Scores and score differences are rounded to the nearest whole number.

Table 1. Impact Analysis Results for *Ready Mathematics* (Treatment) Schools Compared to *i-Ready Diagnostic* Only (Control) Schools for Mathematics Student Achievement in Grades K–5

Grade	Group	ICC	Schools	Students	<i>i-Ready</i> Mean	<i>i-Ready</i> SD	Adj Mean Diff (SE)	<i>p</i> -value	Effect Size
K	Control	.30	21	889	368.89	23.79	9.25 (3.72)	.013	.36
	Treatment		18	889	378.13	27.67			
1	Control	.17	38	1,978	404.38	25.94	9.33 (1.62)	<.001	.36
	Treatment		25	1,470	413.71	25.99			
2	Control	.18	44	2,347	429.58	27.36	6.88 (1.43)	<.001	.25
	Treatment		24	1,588	436.46	27.01			
3	Control	.21	47	2,221	455.92	28.92	5.06 (1.81)	.005	.17
	Treatment		24	1,751	460.98	30.25			
4	Control	.23	51	2,628	475.42	30.39	6.33 (1.37)	<.001	.21
	Treatment		26	1,782	481.75	31.57			
5	Control	.29	42	2,167	485.96	33.59	8.72 (1.54)	<.001	.26
	Treatment		25	1,796	494.67	33.74			

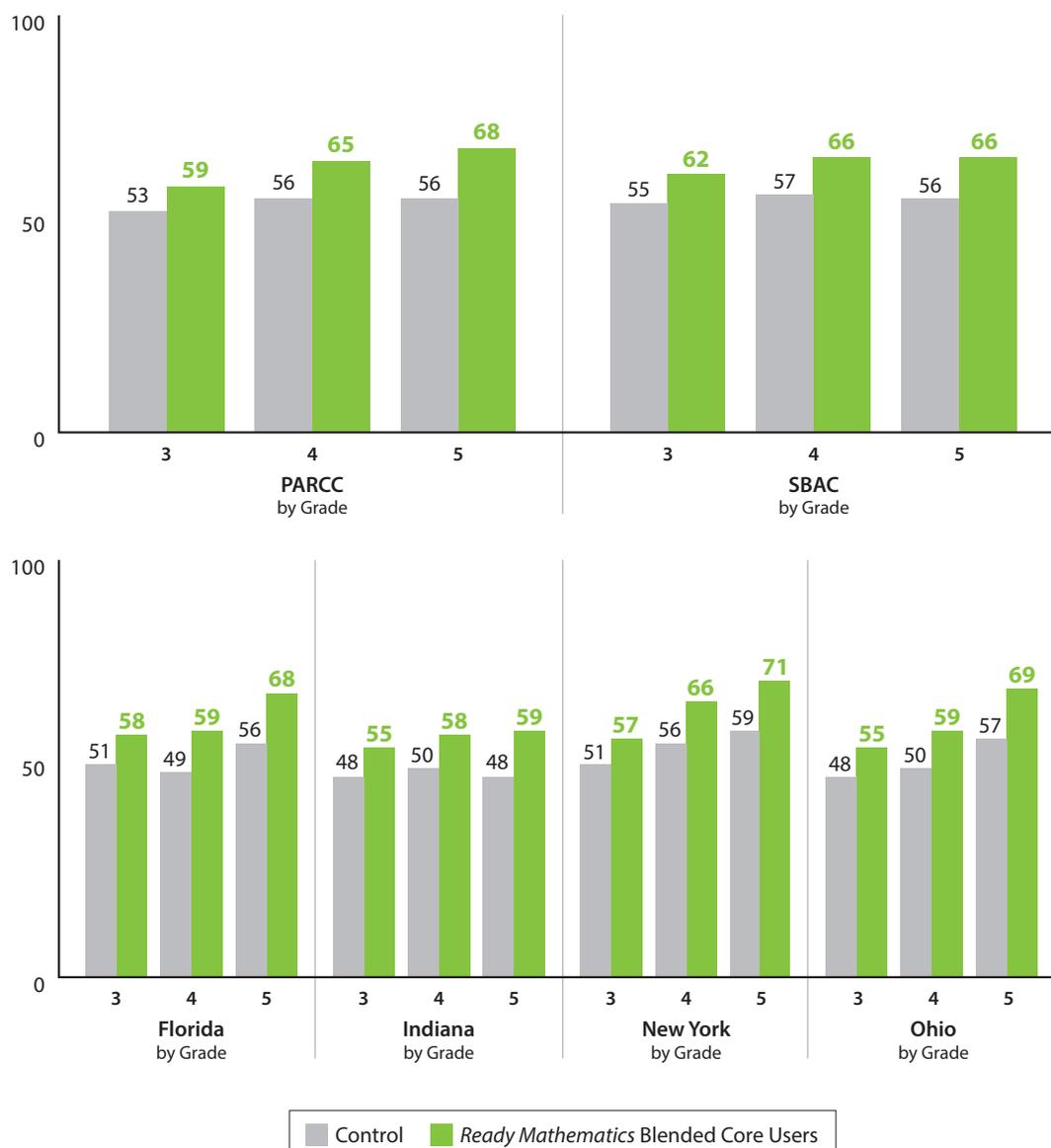
Effect Sizes in Education Research

Effect sizes are a common way of measuring the strength of an educational intervention. While there are many ways to quantify effect sizes, Hedge's *g* is a widely used method for quantifying the differences in the means or averages between two groups, measured in standard deviations. Hedge's *g* is extremely similar to another common effect size, Cohen's *d*, but is more accurate for smaller sample sizes. As with Cohen's *d*, with Hedge's *g* larger effect sizes indicate a greater effect. Because the outcomes are more challenging to influence with interventions, typical effect sizes in research fields such as education, medicine, and economics are smaller than in other fields of research (Lipsey et al., 2012).

Interpreting Results in the Context of State Test Scores

Although the research was not conducted using state test scores, it can be helpful to interpret the results of this study in the context of state summative assessments. The impact of using *Ready Mathematics* is roughly equivalent to students scoring 6–12 percentile ranks higher than they would have otherwise scored on state summative assessments such as Partnership for Assessment of Readiness for College and Careers (PARCC), Smarter Balanced Assessment Consortium (SBAC), and the state tests from Florida, Indiana, New York, and Ohio.

Figure 2. Approximated Percentile Rank Differences on Typical State Tests



Summary of Findings

HumRRO's findings suggest participation in *Ready Mathematics* resulted in higher student-level achievement in mathematics, as measured by the *i-Ready Diagnostic*, compared to a control group of students using only the Diagnostic. For students with comparable starting points, the mean mathematics achievement for the *Ready Mathematics* group was statistically significantly higher in all grades K–5. Moreover, the effect sizes showed additional support that students in *Ready Mathematics* schools benefited from their school's adoption and implementation of the *Ready Mathematics* core curriculum and *i-Ready Personalized Instruction*. This study is further instructional as it yields ESSA Level 2 evidence for the *Ready Mathematics* program and also meets the requirements for the WWC for quasi-experimental designs.

About *Ready Mathematics*

Ready Mathematics helps teachers create a rich classroom environment in which students at all levels become active, real-world problem solvers. Through teacher-led instruction, students develop mathematical reasoning, engage in discourse, and build strong mathematical habits. The program's instructional framework supports educators as they strengthen their teaching practices and facilitates meaningful discourse that encourages all learners. *Ready Mathematics*:

- Encourages students to develop a deeper understanding of mathematics concepts through the embedded Standards for Mathematical Practice.
- Builds on students' prior knowledge with lessons that make connections within and across grade levels and directly address the major focus of the grade.
- Incorporates a classroom mathematics routine that promotes conversations and increases accessibility of the mathematics for all students.
- Prepares students for the challenges of the state assessment with tasks and activities that have a balance of conceptual understanding, procedural skills, fluency, and application.

For Additional Information

Please contact Curriculum Associates at research@cainc.com with additional questions about this study or to receive a copy of HumRRO's research paper.

Works Cited

- Lipsey, M. W., Puzio, K., Yun, C., Hebert, M. A., Steinka-Fry, K., Cole, M. W., et al. (2012). Translating the Statistical Representation of the Effects of Education Interventions into More Readily Interpretable Forms. (NCSE 2013-3000). Washington, DC: National Center for Special Education Research, Institute of Education Sciences, U.S. Department of Education. This report is available on the IES website at <http://ies.ed.gov/ncser/>.
- U.S. Department of Education, Office of Elementary and Secondary Education. (2016, September). Non-Regulatory Guidance: *Using Evidence to Strengthen Education Investments*. Retrieved from <https://www2.ed.gov/policy/elsec/leg/essa/guidanceuseinvestment.pdf>.
- What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (2017a, October). *What Works Clearinghouse: Procedures Handbook (Version 4.0)*. Retrieved from <http://whatworks.ed.gov>.
- What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (2017b, October). *What Works Clearinghouse: Standards Handbook (Version 4.0)*. Retrieved from <http://whatworks.ed.gov>.

Curriculum Associates' *Ready* is a rigorous classroom instruction and practice program that fully prepares students for the demands of today's reading and mathematics standards in a highly interactive way, while providing teachers with step-by-step, point-of-use support to teach most effectively.

To learn more about evidence on the impact of *Ready*, please visit CurriculumAssociates.com/Research.



@myiready



Curriculum Associates



@CurriculumAssoc



iReady