HMH

# RESEARCH
# RESULTS:

## Modesto City Schools

MATH 180®

# THE HMH RESEARCH MISSION STATEMENT

Houghton Mifflin Harcourt® (HMH®) is committed to developing innovative educational programs that are grounded in evidence and efficacy. We collaborate with school districts and third-party research organizations to conduct research that provides information to help improve educational outcomes for students, teachers, and leaders at the classroom, school, and district levels. We believe strongly in a mixed-methods approach to our research, an approach that provides meaningful and contextualized information and results.

# Students experienced statistically significant gains in HMH *Math Inventory*™ Quantile® scores after using *MATH 180*®.

## THE CHALLENGE

Across the country, students are struggling with mathematics. Nearly two-thirds of our nation's eighth graders do not meet current mathematics standards (National Center for Education Statistics, 2015). These standards define the foundational skills students need to master in order to succeed in algebra, a known gatekeeper for college and career readiness. Struggling students often need additional mathematics support to fill in gaps in mathematics knowledge. Modesto recognized this struggle among its students and needed a plan of action.

## PROFILE

**DISTRICT:**
Modesto City Schools, CA

**GRADES:**
7–8

**STUDY DESIGN:**

Bronze Level[1]

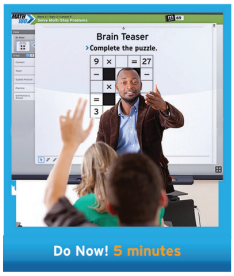
**EVALUATION PERIOD:**
2013–2014 and 2014–2015 school years

**MEASURES:**
*MATH 180* Course I software use, HMH *Math Inventory*


[1] Bronze level studies use a variety of designs, such as single-subject designs, pre- and posttests, qualitative case studies, ethnography, and self-report surveys, among other design types. While informative, these studies are not eligible to meet What Works Clearinghouse standards. Following the Every Student Succeeds Act categories, these studies provide promising evidence.

## THE SOLUTION

*MATH 180* is designed to address the needs of struggling students in grades 5 and up, and their teachers, equally—building students' confidence with mathematics and accelerating their progress to algebra. *MATH 180* picks up the progression to algebra at whole number multiplication and builds a coherent narrative of understanding through fractions and decimals, proportional reasoning, and functional thinking. Conceptual models and procedural strategies build on one another, opening up and facilitating new learning. Instruction is organized into two courses, each with nine Blocks of instruction and three topics within each of the Blocks. *MATH 180* uses a blended learning model where students rotate between teacher-facilitated instruction and personalized software that adapts to their needs.






### WHOLE-CLASS DO NOW

This classroom management routine develops mathematical thinking and makes connections to prior topics.

### GROUP INSTRUCTION

The teacher facilitates instruction to build conceptual understanding, develop reasoning and communication skills, and interpret student thinking.

### PERSONALIZED SOFTWARE

The *MATH 180* software adapts to each student's needs, providing added practice for those who need it and accelerating those ready to move on.

### BRAIN ARCADE

Available anytime, anywhere, the Brain Arcade provides each student with a personalized playlist of games that build strategic and procedural fluency.

## THE STUDY

The purpose of the research was to better understand the implementation of *MATH 180* in Modesto and to examine the achievement outcomes of student participants.

### District Characteristics

Enrolling approximately 30,000 students, Modesto City Schools is a large school district in the Central Valley of California. The district is located 75 miles east of the San Francisco Bay Area and 70 miles south of Sacramento. Almost 60% of the students identify as Hispanic or Latino, and nearly 25% of students identify as white or Caucasian. Approximately 82% of middle school students are eligible to receive free or reduced-price lunches, and nearly 25% of students are English learners.

### Participants

During the 2013–2014 school year, 145 students were enrolled in *MATH 180* Course I. Most of these students (129) were in Grade 7, and 70% were identified as Hispanic. About 78% of students were identified as economically disadvantaged, and 10% of students were identified as having a learning disability.

Similarly, 145 students were enrolled in *MATH 180* Course I during the 2014–2015 school year. More Grade 8 students were enrolled in the program as compared to the previous year (53 students compared to 14 students previously). Approximately 64% of participants were Hispanic, 88% were economically disadvantaged, and 8% were students with disabilities.

Over multiple years of implementation, *MATH 180* has been consistently delivering gains in student math achievement. These gains become even more evident as students interact more and more with the program.


### Implementation

A group of students in the Modesto City School district was enrolled in the *MATH 180* program in addition to their regular grade-level mathematics course. These students were identified as struggling through multiple assessments including performance in previous mathematics classes, state assessment results, recommendations from previous mathematics teachers and parents, and HMH *Math Inventory* results. Students in Grades 7 and 8 used *MATH 180* Course I for 55 minutes a day. *MATH 180* Course I consists of nine instruction Blocks, each covering three topics. The program was implemented as intended, with daily teacher-led instruction and software rotations. Students took the HMH *Math Inventory* in the fall and spring.

## MEASURES

Student progress was measured by average total number of software sessions, topics completed, and average time on software per session. Total number of software sessions and time per session are strong indicators of usage and reflect implementation. Number of topics completed was used to reflect progress through the program. Additionally, student growth in mathematical knowledge was measured by the HMH *Math Inventory* through change in Quantile and performance band. These changes represent growth in student understanding of important math skills and concepts.

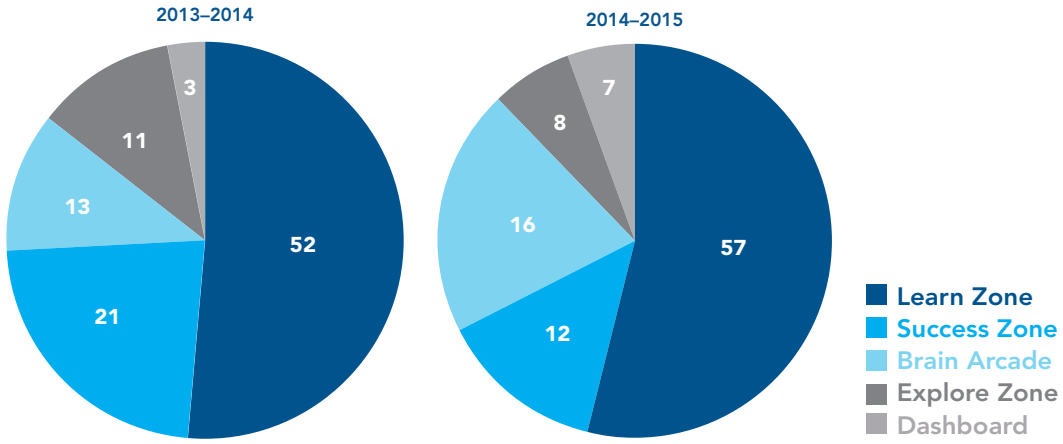
## RESULTS

### Achievement Growth 2013–2014

Students completed an average of 12 topics, or 4 Blocks, over 108 sessions in the software. The average software session was 18 minutes. Students spent the greatest proportion of their software time in the Learn Zone followed by the Success Zone (see Figure 1). Student progress with their teachers during teacher-facilitated instruction was obtained from their completion of mSkills assessments. These assessments were completed after each Block of teacher-facilitated instruction and therefore served as a proxy for completion of that Block. This data indicated that most students had completed Block 5 with their teachers, which tended to be slightly ahead of their software progress on average.

Students' math achievement grew an average of 137 Quantile measures over the school year, starting the program at 520Q and ending the school year at 657Q. This growth over the course of the year was statistically significant where t = 9.50 p<= .01 (see Figure 2).

**FIGURE 1**
**PERCENT OF TIME SPENT IN THE SOFTWARE ZONES, 2013–2014 AND 2014–2015**

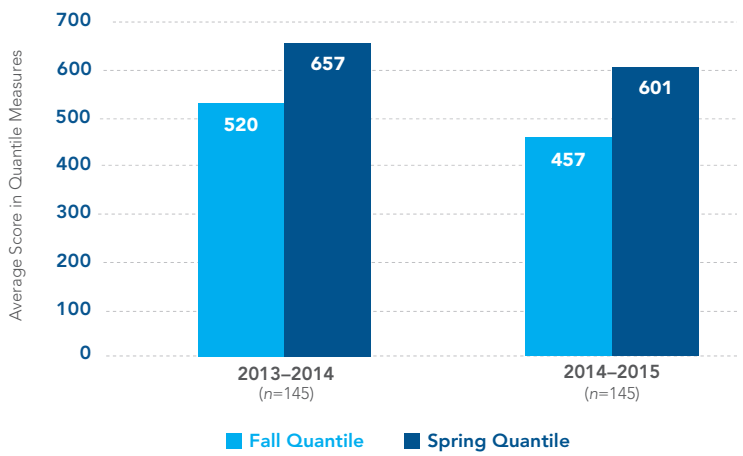



### Achievement Growth 2014–2015

Students completed an average of 14 topics, or almost 5 Blocks, over 103 sessions in the software. The average software session was 15 minutes. Students spent the greatest proportion of their software time in the Learn Zone followed by the Brain Arcade (see Figure 1). One noteworthy change from the 2013–2014 usage data involves the proportion of time spent in the Success Zone. The proportion of time spent during the 2013–2014 school year was 20% compared to only 12% the following year in 2014–2015. Progress with teacher-facilitated instruction indicated that, on average, teachers completed Block 6 of the material with their students.

Students' math achievement grew an average of 144Q over the school year, starting the program at 457Q and ending the school year at 601Q. This growth for the year was also statistically significant where t = 10.63 p<= .01 (see Figure 2).

**FIGURE 2**
**HMH *MATH INVENTORY* SCORES IN QUANTILE MEASURES FROM FALL TO SPRING**

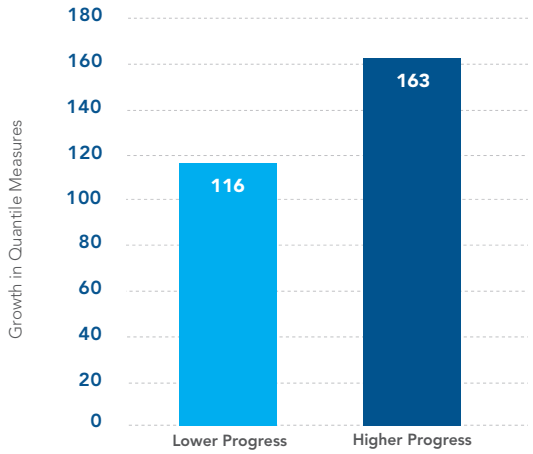



## Growth by Progress

The level of progress through the program is an integral component in trying to understand variations in student achievement gains. If the *MATH 180* program is working as expected, we would predict increased gains for students who have completed more of the program. The proxy for progress through the program for the purposes of this analysis was number of topics completed in the software. In order to investigate the assumption of growth by program usage, the entire sample of students over the two-year period was combined into a single data set. The resulting group of *n*=290 students was divided by the median number of topics completed, which was 13 for this sample. The "Lower Progress" group was comprised of students who completed 1 through 12 topics, and the "Higher Progress" group was comprised of students who completed 13 or more topics.

Both groups began with roughly the same average HMH *Math Inventory* scores: 497 and 482 for the Lower Progress and Higher Progress groups, respectively. Although the Lower Progress group started out slightly higher, this difference was not statistically significant. By the end of the given year the Lower Progress group had an average HMH *Math Inventory* score of 613Q compared to the Higher Progress group which averaged 645Q. Therefore, the Higher Progress group gained an average of 163Q compared to the Lower Progress group that gained an average of 116Q, resulting in a difference of 47Q (see Figure 3). This difference between the two groups was statistically significant where t = 6.3 p<= .01.

**FIGURE 3**
**AVERAGE HMH *MATH INVENTORY* GROWTH BY LEVEL OF PROGRESS THROUGH THE PROGRAM**



## CONCLUSION

In the two years of *MATH 180* implementation included in this analysis, students experienced statistically significant gains in Quantile scores on the HMH *Math Inventory* after using *MATH 180* Course I. Students had a slightly larger average gain in the 2014–2015 school year. This difference may have been influenced by the lower starting Quantile of this group as well as the greater number of topics they completed. For example, when students begin with lower Quantile starting scores relative to their grade, they may have more room to grow. Students in the second year (2014–2015), on average, completed two more topics than students the year before and accomplished it in fewer sessions, pointing to a greater level of progress and efficiency of implementation. This increased efficiency was also accompanied by a slight increase in performance. Prior research (HMH, 2016) has pointed to a connection between progress in the *MATH 180* program and greater Quantile gains when students tend to demonstrate greater growth when they complete more topics.

In analyzing student achievement by level of progress, findings point to significantly greater gains for the students who completed more topics. This seems to support the relationship between program use and student gains in math achievement. However, this should not imply that lower levels of exposure are not without some benefit. Even students with lower levels of completion managed to demonstrate significant levels of growth in their math achievement.

The data from the second year revealed that students were completing more topics in fewer sessions compared to the previous year. In addition, students also spent a lower percentage of time in the Success Zone. These changes may be attributed to some increased efficiencies placed in the program as well as a more efficient use of time by the students. These changes seemed to manifest themselves in greater velocity through the program with no adverse affects on performance.

According to an interview with a district leader, teachers' beliefs and experiences were a strong indicator of student learning outcomes. The teachers who implemented the program with strong fidelity, had taught *MATH 180* previously, believed in the program and the learning model, and volunteered themselves to teach the program rather than having been selected by their principals were the most likely to have students with large learning gains. The potential impact of teachers' experience with the program is seen with larger student Quantile growth in the second year of implementation. A future study should examine the impact of teachers' expectations, implementations, and experience as they relate to students' learning outcomes.

## REFERENCES

Houghton Mifflin Harcourt (2016). Progress Matters: The Positive Quantifiable Effects of *MATH 180* on Student Outcomes. HMH Research Update.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Mathematics Assessment.

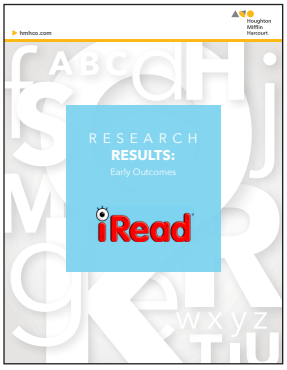
## NOTES

# HMH Research Publications

## Research Into Practice Into Results

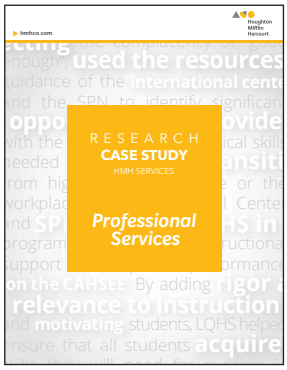

### Research Foundations

Research Foundations papers, which include the Evidence and Efficacy papers, provide an in-depth account of the theoretical underpinnings, evidence base, and expert opinions that guide the design and development of new and revised programs. Research Foundations map known research and design principles to practical applications of the program.




### Research Results including Efficacy Compendiums

Research Results papers document the efficacy of a program in terms of Gold level studies (strong evidence), Silver level studies (moderate evidence), and Bronze level studies (promising evidence). At HMH®, program efficacy is monitored closely and continuously in a variety of settings, including varying geographical locations, implementation models, and student populations.

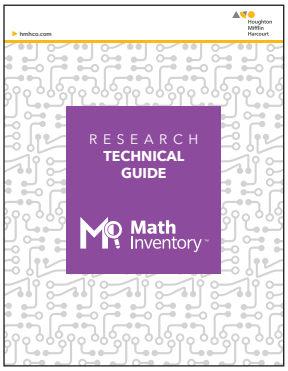



### Research Case Studies

Research Case Study papers showcase research that is primarily qualitative and/or anecdotal. Research Case Study papers may profile a particular educator, student, implementation, or special population of students. Research Case Study papers strive to provide more context for understanding programs in practice.


### Research Professional Papers

Research Professional Papers are typically authored by an expert in the field and highlight an important theoretical construct, practical application, program component, or other topic related to learning in the context of HMH programs.




### Research on Assessments

Research Assessments such as the Technical Guide accompany the release of a stand-alone assessment to demonstrate its reliability and validity. Technical Guides and supporting papers are periodically updated as additional reliability and validity evidence is collected in support of an assessment's use and functionality.

# RESEARCH RESULTS PAPER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