Proven Practices

Development and Validation of Mathway—A New Math Corps Benchmark Assessment

Math Corps is an evidence-based, high dosage tutoring program for students in grades 4-8 (Parker et al., 2019; Codding et al., 2022). Math Corps tutors are AmeriCorps members who receive training and coaching to deliver the program model as intended. The program also uses a data-based decision-making framework for selecting students, growth monitoring, and tutoring exit decisions. For a full overview of Math Corps, refer to *readingandmath.org*.

The Project

This multi-year project sought to iteratively develop and validate a new Math Corps benchmark assessment (Mathway). Mathway complements the Math Corps program by providing tutors with assessment data that are directly linked to the intervention and aligned with commonly used broad-based assessments of math achievement used in schools. The Mathway project included a Development Phase, Piloting Phase, and Validation Phase.

Why It Matters

The development of a new assessment tool introduces a number of key advantages for the program. Most importantly, developing an assessment that is directly aligned with Math Corps skills substantially improves the value of the data for intervention decision-making and evaluation of impact on target skills. Relatedly, internal control of the assessment creates the opportunity to modify and improve the assessment over time as needed. Second, the annual and per-student cost of the previous assessment tool was a significant obstacle for scaling.

Key Takeaways

- ✓ Mathway content aligns with state and national curricular standards related to whole and rational number understanding as well as algebraic reasoning. In addition to curricular standards, guidance for Mathway items was informed by teachers, researchers, and tutors.
- ✓ Mathway is specific to each grade and consists of 23-34 items that increase in difficulty. The web-based assessment provides information on overall student performance for evaluation and can be disaggregated by intervention units for intervention decision-making. The average time to complete the assessment is 15 minutes.
- ✓ Mathway field testing, piloting, and validation leveraged data from over 5,000 students and many more test administrations.
- ✓ Mathway is predictive of student performance on nationally adopted achievement tests and evidence supports its use as a tool for determining Math Corps eligibility and when tutoring can be removed.

Initial Development

The procedures for content blueprinting included review of national math standards, the Math Corps scope and sequence, and empirical research on foundational math skills. These reference points provided the expected skillset within a given-grade (i.e., standard alignment), the expected skillset among students served by the program (i.e., program alignment), and curriculum-independent skills associated with long-term success in math (i.e., empirical review). In addition, the development team reviewed existing assessments used in schools to guide the structure of items. The guidelines above informed a structured process to item writing that included identifying the number of items needed for each Math Corps intervention unit, drafting items, content review, and data-based review.

Piloting and Validation

Mathway items were piloted in the winter and spring of 2021 in grades K-3 (n = 219) and grades 4-8 (n = 299). Piloting focused on the relative difficulty of individual items, their feasibility, and utility. Pilot data informed the ordering of Mathway items prior to large scale validation. Approximately 3,600 students in grades K-3 and 2,700 students in grades 4-8 completed Mathway during the 2022-23 academic year. In addition, a subset of K-3 students and all 4-8 students also completed either aMath or STAR Math on each assessment occasion.

Internal consistency estimates for Mathway were very strong, ranging from .84 to .93. In addition, Mathway demonstrated sensitivity to intervention exposure, with the average percentage of correct responses increasing 30% from fall to spring across grades. Validity estimates for Mathway are displayed in the accompanying table. These estimates represent the correlation between scores on Mathway and aMath (K-3) or STAR Math (4-8) and generally align with similar studies in which scores from two related assessments are correlated. The validity correlations provide evidence that Mathway performance is predictive of overall math achievement on commonly used school-based assessments. For example, the observed correlations allow Math Corps to predict the probability that any given student will meet grade-level benchmarks based on their Mathway performance alone. This is noteworthy because Mathway content is restricted to a select—albeit pivotal—range of grade-level standards.

Grade	Average Concurrent Validity Correlation
KG	0.56
1	0.64
2	0.54
3	0.40
4	0.60
5	0.70
6	0.63
7	0.58
8	0.57

Recommendation for Use

Math Corps currently uses Mathway for programmatic decision making. The assessment has garnered evidence that it is (1) aligned with Math Corps intervention targets, (2) internally consistent, (3) sensitive to changes in student skills, (4) predictive of overall math achievement, and (5) time efficient, with an average administration time of 15 minutes. For these reasons, Mathway is an appropriate assessment tool for identifying students for support, monitoring response to intervention, and making exit decisions. Future technical validation data may inform changes to the assessment design and administration. This is in fact a primary reason for the use of an internal assessment that can be updated based on new learnings and the needs of the student population.