

Early Math Fluency CBM Probe: Quantity Discrimination

This introduction to the Quantity Discrimination probe provides information about the preparation, administration, and scoring of this Early Math CBM measure. Additionally, it offers brief guidelines for integrating this assessment into a school-wide 'Response-to-Intervention' model.

Quantity Discrimination: Description (Clarke & Shinn, 2004; Gersten, Jordan & Flojo, 2005)

The student is given a sheet containing pairs of numbers. In each number pair, one number is larger than the other. The numbers in each pair are selected from within a predefined range (e.g., no lower than 0 and no higher than 20). During a one-minute timed assessment, the student identifies the larger number in each pair, completing as many items as possible while the examiner records any Quantity Discrimination errors.

Quantity Discrimination: Preparation

The following materials are needed to administer Quantity Discrimination (QD) Early Math CBM probes:

- Student and examiner copies of a QD assessment probe. (**Note:** Customized QD probes can be created conveniently and at no cost using Numberfly, a web-based application. Visit Numberfly at <http://www.interventioncentral.org/php/numberfly/numberfly.php>).
- A pencil, pen, or marker
- A stopwatch

Quantity Discrimination: Directions for Administration

1. The examiner sits with the student in a quiet area without distractions. The examiner sits at a table across from the student.
2. The examiner says to the student:

"The sheet on your desk has pairs of numbers. In each set, one number is bigger than the other."

"When I say, 'start,' tell me the name of the number that is larger in each pair. Start at the top of this page and work across the page [demonstrate by pointing]. Try to figure out the larger number for each example.. When you come to the end of a row, go to the next row. Are there any questions? [Pause] Start. "

NOTE: If the student has difficulties with speech production, the examiner can use this alternate wording for directions: *"When I say, 'start,' point to the number that is larger in each pair"*

3. The examiner begins the stopwatch when the student responds aloud to the first item. If the student hesitates on a number for 3 seconds or longer on a Quantity Discrimination item, the examiner says, *"Go to the next one."* (If necessary, the examiner points to the next number as

a student prompt.)

4. The examiner marks each Quantity Discrimination error by marking a slash (/) through the incorrect response item on the examiner form.
5. At the end of one minute, the examiner says, "Stop" and writes in a right-bracket symbol (]) on the examiner form after the last item that the student had attempted when the time expired. The examiner then collects the student Quantity Discrimination sheet.

Quantity Discrimination: Scoring Guidelines

Correct QD responses include:

- Quantity Discriminations read correctly
- Quantity Discriminations read incorrectly but corrected by the student within 3 seconds

Incorrect QD responses include:

- The student's reading the smaller number in the QD number pair
- Correct QD responses given after hesitations of 3 seconds or longer
- The student's calling out a number other than appears in the QD number pair
- Response items skipped by the student

To calculate a Quantity Discrimination fluency score, the examiner:

1. counts up all QD items that the student attempted to answer and
2. subtracts the number of QD errors from the total number attempted.
3. The resulting figure is the number of correct Quantity Discrimination items completed.(QD fluency score).

Quantity Discrimination Probes as Part of a Response to Intervention Model

- **Universal Screening:** To proactively identify children who may have deficiencies in development of foundation math concepts, or 'number sense' (Berch, 2005), schools may choose to screen all kindergarten and first grade students using Quantity Discrimination probes. Those screenings would take place in fall, winter, and spring. Students who fall below the 'cutpoint' of the 35th percentile (e.g., Gersten, Jordan & Flojo, 2005).of the grade norms on the QD task would be identified as having moderate deficiencies and given additional interventions to build their 'number sense' skills.
- **Tier I (Classroom-Based) Interventions:** Teachers can create Quantity Discrimination probes and use them independently to track the progress of students who show modest delays in their math foundation skills.
- **Tier II (Individualized) Interventions.** Students with more extreme academic delays may be referred to a school-based problem-solving team, which will develop more intensive, specialized interventions to target the student's academic deficits (Wright, 2007). Quantity

Discrimination probes can be used as one formative measure to track student progress with Tier II interventions to build foundation math skills.

Quantity Discrimination: Measurement Statistics

Test-Retest Reliability Correlations for Quantity Discrimination Probes		
<i>Time Span</i>	<i>Correlation</i>	<i>Reference</i>
13-week interval	0.85	Clarke & Shinn (2004)
26-week interval	0.86	Clarke & Shinn (2004)

Predictive Validity Correlations for Quantity Discrimination Probes		
<i>Predictive Validity Measure</i>	<i>Correlation</i>	<i>Reference</i>
Curriculum-Based Measurement Math Computation Fluency Probes: Grade 1 Addition & Subtraction (Fall Administration of QD Probe and Spring Administration of Math Computation Probe)	0.67	Clarke & Shinn (2004)
Woodcock-Johnson Tests of Achievement: Applied Problems subtest (Fall Administration of QD Probe and Spring Administration of WJ-ACH subtest)	0.79	Clarke & Shinn (2004)
Number Knowledge Test	0.53	Chard, Clarke, Baker, Otterstedt, Braun & Katz.(2005) cited in Gersten, Jordan & Flojo (2005)

References

Chard, D. J., Clarke, B., Baker, S., Otterstedt, J., Braun, D., & Katz, R. (2005). Using measures of number sense to screen for difficulties in mathematics: Preliminary findings. *Assessment For Effective Intervention, 30*(2), 3-14.

Clarke, B., & Shinn, M. (2004). A preliminary investigation into the identification and development of early mathematics curriculum-based measurement. *School Psychology Review, 33*, 234–248.

Gersten, R., Jordan, N.C., & Flojo, J.R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities, 38*, 293-304.

Berch, D. B. (2005). Making sense of number sense: Implications for children with mathematical disabilities. *Journal of Learning Disabilities, 38*, 333-339..

Wright, J. (2007). *The RTI toolkit: A practical guide for schools*. Port Chester, NY: National Professional Resources, Inc.