

Math Assessment: Determining Instructional Needs and Monitoring Progress

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Learning Objectives for this Presentation

- Understanding math disabilities
- Definitions and roles of assessment
- Examples of norm-referenced formal assessments for math
- Examples of informal math assessments
- Resources:
 - Tests
 - Instructional applications

Definitions of Math Disability

- There is no universal definition!
- *The complexity of numerical processing has made defining what it means to have a specific mathematical learning disability (dyscalculia) difficult.* (Butterworth, 2003)

Definitions of Math Disability (2)

- The Department of Education and Skills, London, 2001:
 - A condition that affects the ability to acquire arithmetic skills. Dyscalculia learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence."

Definitions of Math Disability (3)

- International Dyslexia Association
 - **Dyscalculia** : A mathematical disability in which a person has unusual difficulty solving arithmetic problems and grasping math concepts.
- www.ld.org
 - A term referring to a wide range of life-long learning difficulties involving math. There is no single form of a math disability, and difficulties vary from person to person and affect people differently in school and throughout life.

Definition of Math Disability

- **Common characteristics include:**
 - Difficulty with counting
 - Learning number facts and doing math calculations
 - Difficulty with measurement, telling time, counting money
 - Estimating number quantities
 - Trouble with mental math and problem-solving strategies
- National Center for LD (2014)

More signs and symptoms of Math Disability-2

- Exhibits these difficulties
<http://ldaamerica.org/types-of-learning-disabilities/dyscalculia/> :
 - Understanding concepts of place value, and quantity, number lines, positive and negative value, carrying and borrowing
 - Understanding and doing word problems
 - Sequencing information or events
 - Using steps involved in math operations
 - Understanding fractions

More signs and symptoms of Math Disability-3

- Trouble making change and handling money
- Struggles in recognizing patterns when adding, subtracting, multiplying, or dividing
- Trouble putting language to math processes
- Understanding concepts related to time such as days, weeks, months, seasons, quarters, etc.
- Organizing problems on the page, keeping numbers lined up, following through on long division problems

Learning Disabilities Association of America

Prevalence of Math Learning Disabilities

- Approximately 6% of the school population has difficulties in mathematics which cannot be attributed to low intelligence, sensory deficits, or economic deprivation.

• R. Pierangelo | G. Giuliani (2010)

Prevalence of problems with math for children with disabilities

- 2013 National Assessment of Educational Progress (NAEP) assessment data indicate that 45% of fourth graders and 65% of eighth graders with disabilities lack basic math skills.

<http://www.intensiveintervention.org/mission-action#sthash.vCNf7r0U.dpuf>

What is assessment?

- Assessment is primarily an information gathering process
- It is undertaken to solve a problem
- It culminates in decisions and actions

Different kinds of assessment

- **Summative: assessment OF learning (after instruction)**
 - Applies to long-term learning goals
 - Yields information about accumulated and integrated knowledge and/or complex skills
 - Usually norm-referenced data
- **Formative: assessment FOR learning (can be done during instruction)**
 - Applies to immediate or short term learning goals
 - Gives information about a person's progress acquiring specific skills or knowledge
 - Creates a detailed record of learning
 - Can be used for progress monitoring

Challenges of Math Assessment

- Many more materials are available for screening, progress monitoring and intervention in Reading
- Nature of what is required keeps changing as student progresses through the grades
- Proficiency in one math skill is not necessarily generalizable to another skill
- Early Grades Focus:
 - Early math concepts
 - Number combinations
 - Procedural calculations

Challenges of Math Assessment-2

More difficult to predict when students might begin to struggle because nature of what is required changes as they progress

- Grades 2-3
 - Heavier focus on word problems
- Grade 4
 - Moving from primary focus on addition and subtraction to multiplication and division
 - Moving from whole numbers to fractional quantities
- Grades 5 +
 - Geometry and Algebra

Lynn Fuchs <http://www.rti4success.org/video/there-lot-information-about-rti-reading-how-it-different-math>

Underlying Causes of Poor Math Skills

- Visual-spatial difficulties
- Weakness in Visual processing of numbers and mathematical situations
- Auditory processing difficulties
- Attention deficits
- Memory problems
- Information processing deficits
- Motor disabilities
- Problems with sequencing, organizing information
- Problems with understanding concepts and symbols

www.idonline.org

Changes Related to Math Disabilities in *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition (DSM-5)

- Guides professionals to recognize, diagnose, and treat developmental health disorders
- Controversial change: dyslexia, dyscalculia, disorder of written expression have been removed as types of learning disorders
- Specific learning disorder broadens DSM-IV criteria to represent distinct disorders that interfere with acquisition of academic skills

Changes Related to Math Disabilities in *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edition (DSM-5) -2

Specific learning disorder

- A neurodevelopmental disorder of biological origin manifested in learning difficulties and problems in acquiring academic skills markedly below age level and manifested in the early school years, lasting for at least 6 months; not attributed to intellectual disabilities, developmental disorders, or neurological or motor disorders
- Specify if:
 - 315.00 With impairment in reading.
 - 315.2 With impairment in written expression
 - 315.1 With impairment in mathematics
- Specify current severity:
 - Mild
 - Moderate
 - Severe

• American Psychiatric Association (2013)

Rationale for NOT having dyslexia & dyscalculia as disorder names or diagnostic criteria

- Clinicians will be able to make a diagnosis or learning disorder by identifying whether patients are unable to perform academically at a level appropriate to their intelligence and age.
- After a diagnosis, clinicians can provide greater detail into the type of deficit(s) that an individual has through the designated specifiers.

Rationale for NOT having dyslexia & dyscalculia as disorder names or diagnostic criteria-2

- Terms like dyslexia will be included in the descriptive text of specific learning disorder.
- The DSM-5 Neurodevelopmental Work Group concluded that the many definitions of dyslexia and dyscalculia meant those terms would not be useful as disorder names or in the diagnostic criteria.

• American Psychiatric Publishing (2013)

Common Tests Used for Math Assessments

• **Wechsler Individual Achievement Test-3rd ed**

<http://www.pearsonclinical.com/>

- Mathematics Cluster
 - Numerical Operations measuring written mathematics calculations under untimed conditions
 - Mathematical Problem Solving measuring ability to problem solve mathematically using verbal and visual prompts
- Math Fluency Cluster
 - Includes Math Fluency Addition, Subtraction, Multiplication

Common Tests Used for Math Assessments (2)

• **Woodcock-Johnson IV Tests of Achievement**

– www.riversidepublishing.com

- Math Achievement
 - Applied Problems, Calculation, Math Facts Fluency, and Number Matrices
- Math performance
 - Mathematics, Broad Mathematics, Basic Math Skills, Math Problem Solving

Common Tests Used for Math Assessments (3)

• **Key-Math-3**

– <http://www.pearsonclinical.com/talent/products/100000649/keymath3-diagnostic-assessment.html#tab-details>

- Comprehensive system for K-12
 - Screening
 - Progress Monitoring
 - Data Management
 - Reporting
 - Essential Resources (Level 1: K-2; Level 2: Grades 3-6)

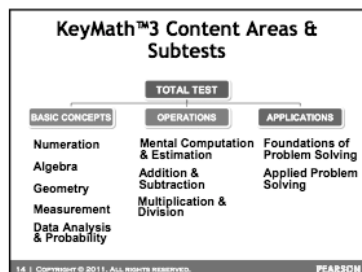
KeyMath-3 Diagnostic Assessment

- Nationally standardized and criterion referenced diagnostic assessment of mathematics concepts and skills
- Untimed and individually administered
- Ages: 4:6 through 21:11 Content: Pre-K to 9
- NCTM Principles/Standards in Math
- 2 forms available to measure progress in 3 month intervals.

KeyMath-3 Diagnostic Assessment

- Measures student's understanding and application of critical math concepts
- 30-90 minute administration time
- Timesaving option to administer select areas
- Manual or computer scoring
- Essential Resources intervention material

KeyMath3 Content



G-MADE (Group Mathematics Assessment and Diagnostic Evaluation) www.pearsondiagnostic.com

- Norm-referenced, standards-based assessment of mathematical skills
- Covers core areas designated by NCTM
- Untimed, but usually takes 50-90 minutes
- Reveals what has been mastered, needs instruction, intervention, or enrichment
- Workbooks available K-3, 4-6, 7-12
- K-12; two forms at each level

G-MADE (Group Mathematics Assessment and Diagnostic Evaluation)-2

- NCTM Content Standards represented
 - Number and operations
 - Algebra
 - Geometry
 - Measurement
 - Data Analysis and probability

G-MADE (Group Mathematics Assessment and Diagnostic Evaluation)-3

- NCTM Process Standards represented
 - Problem Solving
 - Reasoning and proof
 - Communication
 - Connections
 - Representation

Free Resources for Information about Math Assessments

- Center on Response to Intervention
 - <http://www.rti4success.org/resources>
 - Toolcharts from Technical Review Committee
 - Academic Interventions Toolcharts
 - Progress Monitoring Toolcharts
 - Screening Toolcharts
 - Free Webinars (including one on RTI and Mathematics)
 - Training Modules on many aspects of RTI including universal screening
 - Publications including research articles, presentations, tools, and briefs on a range of RTI related topics.
 - Working with National Center on Intensive Intervention at American Institutes for Research

Free Resources for Information about Math Assessments (2)

- National Center on Intensive Intervention at American Institutes for Research
 - Goal: Support schools in data-based individualization in reading, mathematics, and behavior for students with severe and persistent learning and behavioral needs in K-12)
 - <http://www.intensiveintervention.org/>
 - Resources:
 - webinars
 - Ask the Expert
 - Tool Charts
 - Publications
 - Newsletter

National Center on Intensive Intervention at American Institutes for Research

- Mathematics Assessment
 - http://www.intensiveintervention.org/sites/default/files/Mathematics_Assessment_Supplement.pdf
 - Counting
 - Basic Facts
 - Place Value concepts
 - Whole number computation
 - Fractions

Screening Tools for Math

- AIMSweb (www.aimsweb.com)
 - Test of Early Numeracy (TEN)
 - Four assessments to identify and monitor early (K-1) arithmetic skills (each 1 minute)
 - Oral counting
 - Number identification
 - Quantity discrimination (ID bigger number from a pair)
 - Missing number skills (from a number line)

AIMSweb Mathematics Concepts and Applications (M-CAP) Grades 2-8

- Group administered
- Short duration: 8 to 10 minutes
- Broad math domains for Benchmark and Progress Monitoring
 - Number sense
 - Operations
 - Patterns and relationships
 - Data and probability
 - Measurement
 - Data and statistics
 - Geometry
 - Algebra

Curriculum Based Measurement Across Tiers: AIMSweb Timeline

- Tier One: All Students
 - Benchmark assessments 3x year
 - To identify students at-risk
- Tier Two: Some students (mild to moderate risk)
 - Curriculum Based Measurement probes
 - At least 1x month
 - To monitor students with some risk

Curriculum Based Measurement Across Tiers: AIMSweb Timeline

- Tier Three: Some Students (At-Risk)
 - Curriculum Based Measurement probes
 - 1x week
 - To closely monitor students at-risk

On-Line/computer/app based Math Assessments + Interventions

- **Basic Mathematics**
 - Grades K-12
 - <http://www.basic-mathematics.com/math-skills-assessment.html>
 - **Assessments plus instructional supports including:**
 - Whole Number
 - Fractions, Decimals, Ratio and Proportion
 - Percents
 - Basic Geometry
 - Customary measurement
 - Sequences and patterns
 - Graphs

On-Line/computer/app based Math Assessments + Interventions-2

- **Xtra Math**
 - www.xtramath.com (app also available)
 - Free, web-based math fact fluency program
 - Recall of basic arithmetic facts is essential for success with fractions, decimals, and multi-digit algorithms.
 - Frees up mental resources for more complex problem solving.
 - 10 minutes per day for basic math facts
 - Weekly progress reports for parents/teachers

Some Promising Assessment Resources on-line

- Mathematics Assessment Project (tools for formative and summative assessment) Grades 2-high school
 - <http://map.mathshell.org/materials/index.php>
- Inside Mathematics
 - <http://www.insidemathematics.org/performance-assessment-tasks> (Middle-high school)

Useful online resources

- www.dyscalculia.org
 - Math learning disability resources including:
 - Assistive technology
 - Apps
 - Lessons
 - Books and Tools
 - Assistance with diagnosis, accommodations, treatment
- Screening for Mathematics Difficulties in K-3
 - <http://files.eric.ed.gov/fulltext/ED521575.pdf>

Useful online resources (2)

- <http://www.pbs.org/parents/education/learning-disabilities/types/mathematics/math-strategies/>
 - Suggestions for ways parents can help their children cope with problems with math
- <http://www.ldonline.org/article/5896/>
 - Informative article by Dr. Kate Garnett about math learning disabilities

Useful online resources (3)

- <http://educationnorthwest.org/resources/mathematics-interventions-what-strategies-work-struggling-learners-or-students-learning>
 - Resources in the public domain for students with math disabilities
- http://www.mathlanding.org/collections/pd_collection/strategies-teaching-students-struggling-mathematics
 - Collection of resources including journal articles

Useful online resources (4)

- www.dyscalculiainfo.org
- www.aboutdyscalculia.org/resources.html
- <http://www.helpingwithmath.com/resources/wor-dyscalculia.htm>
- <https://www.tes.co.uk/teaching-resource/dyscalculia-resource-treasure-collection-6302884>