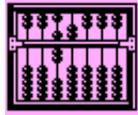
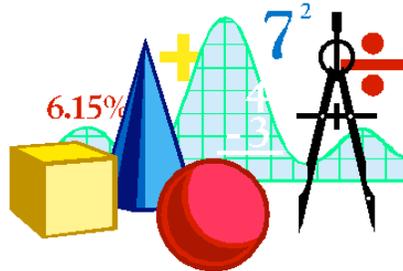
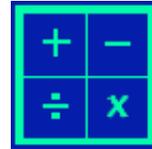


Paula's Special Education Resources



The Math Page



This site references math [research/](#) [strategies/](#) [learning materials/](#) [resources /](#) [math links](#) focusing on Math Learning Differences and related material. [Worksheets for tutoring](#)

Often referred to as dyscalculia, math-related learning disabilities are complex and require intervention by skillful teachers to help students achieve success.

Definition: Dyscalculia is a term used to refer to learning disabilities that involve arithmetic comprehension or computation. This difficulty in mastering concepts or computations is usually associated with neurological dysfunction or brain damage and is classified as developmental (occurring before birth from genetic or congenital problems) or acquired (occurring after birth usually from a traumatic brain injury). To be classified with dyscalculia, a child must have intellectual functioning that falls within or above the normal range and a significant discrepancy between his/her age and math skills (usually 2 years or more). Often children with dyscalculia show a spread of 20 points or more between their verbal and performance scores on WISC intelligence testing. *For a child to be diagnosed with dyscalculia, it is important to make sure his math deficits are not related to issues like inadequate instruction, cultural differences, mental retardation, physical illness or problems with vision or hearing.*



Research:

[Learning Disabilities in Math](#)

While children with disorders in mathematics are specifically included under the definition of Learning Disabilities, seldom do math learning difficulties cause children to be referred for evaluation. In many school systems, special education services are provided almost exclusively on the basis of children's reading disabilities. Even after being identified as learning disabled (LD), few children are provided substantive assessment and remediation of their arithmetic difficulties.

Math Strategies/Accommodations:

[Dyscalculia: Letter to My Teacher](http://www.shianet.org/~reeneenew/teacher.html)- ie. Classroom learning accommodations/considerations for the student with a math disability. <http://www.shianet.org/~reeneenew/teacher.html>

[Memory Aids for Fractions and Decimals](http://forum.swarthmore.edu/~sarah/hamilton/fracdec.mem.html) - <http://forum.swarthmore.edu/~sarah/hamilton/fracdec.mem.html>

[Chisenbop](http://klingson.cs.iupui.edu/~aharris/basicComputing/bc5a.html)-This is a method of using your two hands

first to count to 100 -- your right hand is the "tens" column. You can then add, subtract, multiply, and divide with your battery-less hand calculator," working problems that go way beyond 100, too.

<http://klingson.cs.iupui.edu/~aharris/basicComputing/bc5a.html>

- [Dyscalculia Screener](#), a computer-based, classroom assessment tool used to identify dyscalculia

Learning Materials:

Everything You Need to Know About Math Homework- A Desk Reference for Students and Parents, by Anne Zeman and Kate Kelly, from Scholastic Books Inc. ISBN 0-590-49359-0

Great handbook aimed at 4th-6th math concepts. Very visual, bright, with lots of information charts, math vocabulary, formulas, examples of math procedures to solve problems etc. Great reference tool for parents also in helping your child get through math by providing examples and explanations. Scholastic has a whole series of these books in all subject areas.

Math Website/Resource Links

[Kumon Math and Reading](http://www.kumon.com/)- <http://www.kumon.com/>

<http://www.dyscalculia.org/>- lot of info

<http://www.pbs.org/wgbh/misunderstoodminds/mathbasics.html>- Misunderstood Minds-Math-PBS-Because math is so cumulative in nature, it is important to identify breakdowns as early as possible. Children are more likely to experience success in math when any neurodevelopmental differences that affect their performance in mathematics are dealt with promptly -- before children lose confidence or develop a fear of math.

[What Can Stand in the Way of a Student's Mathematical Development?](http://www.pbs.org/wgbh/misunderstoodminds/mathdiffs.html) - <http://www.pbs.org/wgbh/misunderstoodminds/mathdiffs.html>

[Principles and Standards for School Mathematics](http://standards.nctm.org/)- <http://standards.nctm.org/> NCTM's Principles and Standards for School Mathematics, published in 2000, provides guidelines for excellence in mathematics education and issues a call for all students to engage in more challenging mathematics

[Children's Understanding of Math: Teaching, Learning, and the Brain](http://www.eci.uchicago.edu/conferences/conference10-20-00.html)." Center for Early Childhood Research (CECR). <http://www.eci.uchicago.edu/conferences/conference10-20-00.html>

Principles for Designing Practice Activities



1. Avoid memory overload by assigning manageable amounts of practice work as skills are

learned.

2. Build retention by providing review within a day or two of the initial learning of difficult skills, and by providing supervised practice to prevent students from practicing misconceptions and "misrules."
3. Reduce interference between concepts or applications of rules and strategies by separating practice opportunities until the discriminations between them are learned.
4. Make new learning meaningful by relating practice of subskills to the performance of the whole task, and by relating what the student has learned about mathematical relationships to what the student will learn about mathematical relationships.
5. Reduce processing demands by preteaching component skills of algorithms and strategies, and by teaching easier knowledge and skills before teaching difficult knowledge and skills.
6. Require fluent responses.
7. Ensure that skills to be practiced can be completed independently with high levels of success.

Note. Adapted from Carnine (1989).

Options for Presenting and Responding to Math Problems

Presentation options

- Construct a problem with actual objects or manipulatives.
- Present a problem in a fixed visual display.
- Orally state the problem.
- Present the problem in written or symbolic form

Response options

- Construct a response by manipulating objects.
- Choose from an array of possible responses (i.e., multiple choice)
- Make an oral response.
- Make a written or symbolic representation.

Note. Adapted from Cawley et al. (1978).

The following are ways in which weaknesses in selected components of information processing may affect math performance:

Attention deficits:

1. Student has difficulty maintaining attention to steps in algorithms or problem solving.
2. Student has difficulty sustaining attention to critical instruction (e.g., teacher modeling)

Visual-spatial deficits:

1. Student loses place on the worksheet.
2. Student has difficulty differentiating between numbers (e.g., 6 and 9; 2 and 5; or 17 and 71), coins, the operation symbols, and clock hands.
3. Student has difficulty writing across the paper in a straight line.
4. Student has difficulty relating to directional aspects of math, for example, in problems involving up-down (e.g., addition), left-right (regrouping), and aligning of numbers.

5. Student has difficulty using a number line.

Auditory-processing difficulties:

1. Student has difficulty doing oral drills.
2. Student is unable to count on from within a sequence.

Memory problems:

1. Student is unable to retain math facts or new information.
2. Student forgets steps in an algorithm.
3. Student performs poorly on review lessons or mixed probes.
4. Student has difficulty telling time.
5. Student has difficulty solving multi-step word problems.

Motor disabilities:

1. Student writes numbers illegibly, slowly, and inaccurately.
2. Student has difficulty writing numbers in small spaces (i.e., writes large).

Suggested Mathematics Learning Accommodations for Specific Learning Disabilities

These are suggestions for mathematics learning accommodations based on specific learning disabilities. These learning accommodations have been proven successful with many learning disabled students. Not all of these learning accommodations are usually needed for most of the learning disabled students. Even using all these learning accommodations may not circumvent every student's learning disability. However, in every case the learning disabled students must be taught math study skills to help compensate for their learning problems.

Visual Processing Speed/Visual Processing

Note-taker* Re-Work notes* Tape Recorder with tape counter* Large print handouts* Large print copies of important textbook pages* Taped textbook* Turn note book sideways* Take notes in different pen colors* Trained tutors

Short-Term Memory/Auditory Processing

Note-takers* Re-work notes* Tape recorder with tape counter* Physical proximity Math video tapes* Trained tutor* Tape record important tutor explanations

Fluid Reasoning/Long Term Retrieval

Note-takers* Re-work notes* Tape recorder with tape counter* Handouts* Math video tapes* Fact sheets (flash cards)* Color coded problem steps* Trained tutor* Tape record important tutor explanations* Strategy Cards for Higher Grades* Calculators

Suggested Mathematics Testing Accommodations For Specific Learning Disabilities

Visual Processing Speed/Visual Processing

Extended time* Private test area* Quiet test area* Enlarged test questions* Test readers* Recording test on audio tape* Kinesthetic options(chalkboard)* Specially lined/oriented paper* Color coded math equations* Calculators

Short-term Memory/Audio Processing

Extended time * Private test area * Quiet test area* Recording test on audio tape

Fluid Reasoning/Long-term Memory

Extended time * Private test area * Quiet test area* Fact sheet handouts * Strategy Cards for Higher Grades *Clarification of test questions * Calculations

Alternative Test Formats

Oral test *Video monitored enlarged test * Computer enlarged test * Computer speech enhanced test * Take home test



Grade Your Child's Math Class

A math class should teach practical experiences in mathematical skills that are a bridge to the real world of jobs and adult responsibilities. This means going beyond memorization into a world of reasoning and problem solving.

Would you recognize a good math class if you saw one?

Look for these changes from the traditional classroom to see if your child's school is preparing its students for the world outside.

What are students doing?

Interacting with each other as well as working independently, just as adults do at work.

Using textbooks as only one of many resources.

Manipulatives, such as blocks and scales; and technology, such as calculators and computers, are useful tools, and students should be learning how and when to use them.

Becoming aware of how math is applied to real life problems, not just learning a series of isolated skills.

And, as in real life, complex problems are not solved quickly.

Realizing that many problems have more than just one "right" answer.

Students can explain the different ways they reach a variety of solutions and why they make one choice over another.

Working in groups to test solutions to problems. Students should be very involved, more than merely "listeners."

Learning how to communicate mathematical ideas to one another.

Working in a physical setting that promotes teamwork and helps kids challenge and defend possible solutions.

Computers are only one way that students can interact with each other.

What are teachers doing?

Raising questions that encourage students to explore several solutions and challenging deeper thinking about real problems.

Moving around the room to keep everyone engaged and on track.

Allowing students to raise original questions about math for which there is no "answer in the book," and promoting discussions of these questions, recognizing that it may be other students who will find reasonable answers.

Using manipulatives and technology when it is appropriate, not just as "busy work."

Drawing on student discovery and creativity to keep them interested. The teacher knows that boredom is the enemy of learning.

Encouraging students to go on to the next challenge once a step is learned, understanding that not all students learn at the same pace.

Bringing a variety of resources into the classroom, from guest speakers to creative uses of technology.

Working with other teachers to make connections between disciplines to show how math is a part of every major subject.

Using assessments that reflect the way math is being taught, stressing understanding and problem-solving skills, not just memory.

Exploring career opportunities with students that emphasize mathematical concepts and applications.

Learning also takes place outside school. Thinking mathematically is critical to every life skill, from balancing a checkbook to understanding the newspaper. In today's jobs, people use math skills that require the ability to identify a problem, look for information that will help them solve the problem, consider a variety of solutions, and communicate the best possible solutions to others.

"What to Look for in a Math Classroom?" Annenberg/CPB Math and Science Project.

Darwin, Charles

Mathematics seems to endow one with something like a new sense.

Weyl, Hermann (1885 - 1955)

We are not very pleased when we are forced to accept a mathematical truth by virtue of a complicated chain of formal conclusions and computations, which we traverse blindly, link by link, feeling our way by touch. We want first an overview of the aim and of the road; we want to understand the idea of the proof, the deeper context.

Difficulties with Mathematics

Math disabilities can arise at nearly any stage of a child's scholastic development. While very little is known about the neurobiological or environmental causes of these problems, many

experts attribute them to deficits in one or more of five different skill types. These deficits can exist independently of one another or can occur in combination. All can impact a child's ability to progress in mathematics.

Incomplete Mastery of Number Facts Number facts are the basic computations ($9 + 3 = 12$ or $2 \times 4 = 8$) students are required to memorize in the earliest grades of elementary school. Recalling these facts efficiently is critical because it allows a student to approach more advanced mathematical thinking without being bogged down by simple calculations.

Computational Weakness Many students, despite a good understanding of mathematical concepts, are inconsistent at computing. They make errors because they misread signs or carry numbers incorrectly, or may not write numerals clearly enough or in the correct column. These students often struggle, especially in primary school, where basic computation and "right answers" are stressed. Often they end up in remedial classes, even though they might have a high level of potential for higher-level mathematical thinking.

Difficulty Transferring Knowledge One fairly common difficulty experienced by people with math problems is the inability to easily connect the abstract or conceptual aspects of math with reality. Understanding what symbols represent in the physical world is important to how well and how easily a child will remember a concept. Holding and inspecting an equilateral triangle, for example, will be much more meaningful to a child than simply being told that the triangle is equilateral because it has three equal sides. And yet children with this problem find connections such as these painstaking at best.

Making Connections Some students have difficulty making meaningful connections within and across mathematical experiences. For instance, a student may not readily comprehend the relation between numbers and the quantities they represent. If this kind of connection is not made, math skills may be not anchored in any meaningful or relevant manner. This makes them harder to recall and apply in new situations.

Incomplete Understanding of the Language of Math For some students, a math disability is driven by problems with language. These children may also experience difficulty with reading, writing, and speaking. In math, however, their language problem is confounded by the inherently difficult terminology, some of which they hear nowhere outside of the math classroom. These students have difficulty understanding written or verbal directions or explanations, and find word problems especially difficult to translate.

Difficulty Comprehending the Visual and Spatial Aspects and Perceptual Difficulties. A far less common problem -- and probably the most severe -- is the inability to effectively visualize math concepts. Students who have this problem may be unable to judge the relative size among three dissimilar objects. This disorder has obvious disadvantages, as it requires that a student rely almost entirely on rote memorization of verbal or written descriptions of math concepts that most people take for granted. Some mathematical problems also require students to combine higher-order cognition with perceptual skills, for instance, to determine what shape will result when a complex 3-D figure is rotated.

Signs of Math Difficulties

Output Difficulties

- be unable to recall basic math facts, procedures, rules, or formulas

- be very slow to retrieve facts or pursue procedures
- have difficulties maintaining precision during mathematical work
- have difficulties with handwriting that slow down written work or make it hard to read later
- have difficulty remembering previously encountered patterns
- forget what he or she is doing in the middle of a math problem

Organizational Difficulties

- have difficulties sequencing multiple steps
- become entangled in multiple steps or elements of a problem
- lose appreciation of the final goal and over emphasize individual elements of a problem
- not be able to identify salient aspects of a mathematical situation, particularly in word problems or other problem solving situations where some information is not relevant
- be unable to appreciate the appropriateness or reasonableness of solutions generated

Language Difficulties

- have difficulty with the vocabulary of math
- be confused by language in word problems not know when irrelevant information is included or when information is given out of sequence
- have trouble learning or recalling abstract terms
- have difficulty understanding directions
- have difficulty explaining and communicating about math, including asking and answering questions
- have difficulty reading texts to direct their own learning
- have difficulty remembering assigned values or definitions in specific problems

Attention Difficulties

- be distracted or fidgety during math tasks
- lose his or her place while working on a math problem
- appear mentally fatigued or overly tired when doing math

Visual Spatial or Ordering Difficulties

- be confused when learning multi-step procedures
- have trouble ordering the steps used to solve a problem feel overloaded when faced with a worksheet full of math exercises
- not be able to copy problems correctly
- may have difficulties reading the hands on an analog clock
- may have difficulties interpreting and manipulating geometric configurations
- may have difficulties appreciating changes in objects as they are moved in space

Difficulties with multiple tasks

- find it difficult to switch between multiple demands in a complex math problem
- find it difficult to tell when tasks can be grouped or merged and when they must be separated in a multi-step math problem
- cannot manage all the demands of a complex problem, such as a word problem, even though he or she may know component facts and procedures

Worksheets for Math Tutoring or Practice

Multiplication worksheets- <http://math.about.com/cs/multiplication/a/multws.htm>

Multiplication Grid- <http://math.about.com/blgrid.htm>

Multiplication - Numbers up to 12- interactive- self correcting-
<http://www.kidport.com/Grade3/Math/NumberSense/G3-M-NS-Mult12.htm>

www.multiplicaton.com - worksheets

Multiplication Worksheets from EdHelper.com- <http://www.edhelper.com/multiplication.htm>

Worksheets by grade level - includes math -<http://tlsbooks.com/gradelevel.htm>