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Math Disability: An Overview

Recently, increased attention has focused on students who demonstrate challenges learning mathematics skills and concepts that are taught in school across the grade levels. Beginning as early as preschool, parents, educators, and researchers are noticing that some students seem perplexed learning simple math skills that many take for granted. For example, some young children have difficulty learning number names, counting, and recognizing how many items are in a group. Some of these children continue to demonstrate problems learning math as they proceed through school. In fact, we know that that 5% to 8% of school-age children are identified as having a math disability.¹

Research on understanding more completely what a math disability means and what we can do about it in school has lagged behind similar work being done in the area of reading disabilities. Compared to the research base in early reading difficulties, early difficulties in mathematics and the identification of math disability in later years are less researched and understood.² Fortunately, attention is now being directed to helping students who struggle learning basic mathematics skills, mastering more advance mathematics (e.g., algebra), and solving math problems. This article will explain in detail what a math disability is, the sources that cause such a disability, and how a math disability impacts students at different grade levels.

What is a Math Disability?

A learning disability in mathematics is characterized by an unexpected learning problem after a classroom teacher or other trained professional (e.g., a tutor) has provided a child with appropriate learning experiences over a period of time. Appropriate learning experiences refer to practices that are supported by sound research and that are implemented in the way in which they were designed to be used. The time period refers to the duration of time that is needed to help the child learn the skills and concepts, which are challenging for the child to learn. Typically, the child with a math disability has difficulty making sufficient school progress in mathematics similar to that of her peer group despite the implementation of effective teaching practices over time. Studies have shown that some students with a math disability also have a reading disability or Attention-Deficit/Hyperactivity Disorder (AD/HD). Other studies have identified a group of children who have only a math disability.

Dyscalculia is a term that has been used for many years when talking about a math disability.

Dyscalculia means "a severe or complete inability to calculate".³ Some people use the term dyscalculia to describe a child who has problems learning mathematics skills and concepts. However, the terms **learning disabilities in mathematics** and **math disability** are used more widely today.

Several Sources of Math Disability

When a child is identified as having a math disability, his difficulty may stem from problems in one or more of the following areas: memory, cognitive development, and visual-spatial ability.^{4, 5, 6, 7}

Memory

Memory problems may affect a child's math performance in several ways. Here are some examples:

- A child might have memory problems that interfere with his ability to retrieve (remember) basic arithmetic facts quickly.^{8, 9}
- In the upper grades, memory problems may influence a child's ability to recall the steps needed to solve more difficult word problems,¹⁰ to recall the steps in solving algebraic equations, or to remember what specific symbols (e.g., \hat{a} , s , π , \geq) mean.
- Your child's teacher may say, "He knew the math facts yesterday but can't seem to remember them today."

- While helping your child with math homework, you may be baffled by her difficulty remembering how to perform a problem that was taught at school that day.

Cognitive Development

Students with a math disability may have trouble because of delays in **cognitive development**, which hinders learning and processing information.¹¹ This might lead to problems with:

- understanding relationships between numbers (e.g., fractions and decimals; addition and subtraction; multiplication and division)
- solving word problems
- understanding number systems
- using effective counting strategies

Visual-Spatial

Visual-spatial problems may interfere with a child's ability to perform math problems correctly. Examples of visual-spatial difficulties include:

- misaligning numerals in columns for calculation
- problems with place value that involves understanding the base ten system
- trouble interpreting maps and understanding geometry.¹²

What Math Skills Are Affected?

According to the Individuals with Disabilities Education Act of 2004 (IDEA), a learning disability in mathematics can be identified in the area of mathematics calculation (arithmetic) and/or mathematics problem solving. Research confirms this definition of a math disability.^{13, 14, 15, 16, 17}

Math Calculations

A child with a learning disability in **math calculations** may often struggle learning the basic skills in early math instruction where the problem is rooted in memory or cognitive difficulties. For example, research studies have shown that students who struggle to master arithmetic combinations (basic facts) compared to students who demonstrated mastery of arithmetic combinations showed little progress over a two-year period in remembering basic fact combinations when they were expected to perform under timed conditions. According to Geary (2004),¹⁸ this problem appears to be persistent and characteristic of memory or cognitive difficulties. Students with math calculations difficulties have problems with some or most of the following skills:

- Identifying signs and their meaning (e.g., +, -, x, <, =, >, %, Σ)
- Automatically remembering answers to basic arithmetic facts (combinations) such as $3 + 4 = ?$, $9 \times 9 = ?$, $15 - 8 = ?$.
- Moving from using basic (less mature) counting strategies to more sophisticated (mature) strategies to calculate the answer to arithmetic problems. For example, a student using a basic "counting all" strategy would add two objects with four objects by starting at 1 and counting all of the objects to arrive at the answer 6. A student using a more sophisticated "counting on" strategy would add two with four by starting with 4 and counting on 2 more to arrive at 6.
- Understanding the commutative property (e.g., $3 + 4 = 7$ and $4 + 3 = 7$)
- Solving multi-digit calculations that require "borrowing" (subtraction) and "carrying" (addition)
- Misaligning numbers when copying problems from a chalkboard or textbook
- Ignoring decimal points that appear in math problems
- Forgetting the steps involved in solving various calculations

Math Word Problems

A learning disability in solving **math word problems** taps into other types of skills or processes. Difficulties with any of these skills can interfere with a child's ability to figure out how to effectively solve the problem.¹⁹ Your child may exhibit difficulty with some or most of the processes involved in solving math word problems such as:

- Reading the word problem
- Understanding the language or meaning of the sentences and what the problem is asking
- Sorting out important information from extraneous information that is not essential for solving the problem
- Implementing a plan for solving the problem
- Working through multiple steps in more advanced word problems
- Knowing the correct calculations to use to solve problems

Math Rules and Procedures

Students with a math disability demonstrate developmental delay in learning the **rules and procedures** for solving calculations or word problems. An example of a **math rule** includes "any number $\times 0 = 0$." A **procedure** includes the steps for solving arithmetic problems such as addition, subtraction, multiplication, and division. A delay means the child may learn the rules and procedures at a slower rate than his peer group and will need assistance in mastering those rules and procedures.

Math Language

Some children have trouble understanding **the meaning of the language or vocabulary of mathematics** (e.g., greater than, less than, equal, equation).²⁰ Unfortunately, unlike reading, the meaning of a math word or symbol cannot be inferred from the context. One has to know what each word or symbol means in order to understand the math problem. For instance, to solve the following problems, a child must understand the meaning of the symbols they contain: $(3 + 4) \times (6 + 8) = ?$ or $72 < 108$ True or False?

Math Disability at Different Grade Levels

As the curriculum becomes more demanding, a math disability is manifested in different ways across the grade levels. For example, the specialized language of mathematics — including terms and symbols — must be mastered in more advanced mathematics curriculum. Problems with counting strategies, retrieving basic facts quickly, and solving word problems seem to persist across grade levels and require extra instruction to reinforce learning.

Ongoing Research in Math Disabilities

We do not fully understand how a math disability affects a child's ability to learn mathematics in all of the different areas because of the limited research base on math disability. To date, the majority of research has focused mostly on the skills associated with mathematics calculations including number, counting, and arithmetic (e.g., arithmetic combinations or basic facts) and on solving word problems. Much less is known about development and difficulties in areas such as algebra, geometry, measurement, and data analysis and probability.

We know that a group of students exhibit problems learning mathematics skills and concepts that persist across their school years and even into adulthood. We understand that specific problems in the areas of memory, cognitive development, and visual-spatial ability contribute to difficulties learning mathematics. Fortunately, researchers and educators are focusing efforts on better understanding the issues these students face as they encounter the math curriculum across the grade levels. In my next article, I will explore methods for identifying a math disability and offer parents ideas for working with their children and teachers to address such difficulties.

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